

**SITE REASSESSMENT REPORT**

**LOWER SAN MATEO CREEK BASIN SITE**  
**CIBOLA & MCKINLEY COUNTIES, NEW MEXICO**  
**CERCLIS ID NMN000606847**

**May 2016 (Revision 2)**



**New Mexico Environment Department**  
**Ground Water Quality Bureau**  
**Superfund Oversight Section**

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## **1 Introduction**

Under the authority of the Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 United States Code (U.S.C.) §§ 9601 to 9675, the New Mexico Environment Department (NMED) Superfund Oversight Section (SOS) conducted a Site Reassessment (SR) at the Lower San Mateo Creek Basin Site, CERCLIS ID NMN000606847, (hereafter referred to as the "Site"), in Cibola and McKinley Counties, New Mexico.

The objective of this SR was to acquire recent ground water data to evaluate current water quality conditions; compare contaminant concentrations in the ground water samples to federal drinking water standards and State of New Mexico ground water quality standards; and expand the database of aquifer geochemistry information to support ongoing investigations of potential legacy uranium sites within the San Mateo Creek (SMC) basin and the Grants Mining District.

## **2 Site Description**

### **2.1 Location**

The Site is located in the southern half of the SMC basin in north-central Cibola County and southeastern McKinley County, New Mexico. The Site geographic coordinates (in degrees, decimal minutes) encompass an approximate area from 35°10.207' (south latitude) to 35°21.273' (north latitude) and 107°46.197' (east longitude) to 107°56.184' (west longitude). The elevation across the Site ranges from approximately 6,550 feet to 7,000 feet above mean sea level (MSL). Figure 1 shows the location of the Site investigation area in the SMC basin.

### **2.2 Site Description**

The Site includes the five residential subdivisions (Broadview Acres, Murray Acres, Pleasant Valley Estates, Felice Acres, and Valle Verde) and other residential wells located on rural properties predominantly west, east, south, and north of the HMC site. Within the five subdivisions and generally farther south and west, the land use is predominantly rural residential with some ranching for crop agriculture and livestock, and commercial uses.

The Grants area has an arid high desert climate where the average annual precipitation for the Grants area is 10.40 inches. The maximum average precipitation of 2.03 inches occurs in August, and the minimum average precipitation of 0.44 in. occurs in February. Average annual snowfall is 12.3 inches, with the average maximum snowfall of 4.1 inches occurring in December. Evaporation exceeds precipitation throughout the region, and evapotranspiration is more than 30 inches of water in an average year. The average annual maximum temperature at the Grants Airport is 67.8° F, and the average maximum temperature of 88.4° F occurs in July. The average annual minimum temperature is 33.0° F, and the average minimum temperature of 14.4° F occurs in December.

### **2.3 Operational History, Waste Characteristics, and Previous Environmental Investigations**

Uranium mining has occurred in the San Mateo Creek basin and Ambrosia Lake area beginning in early 1950s through mid-1980s. The legacy mining operations included the discharge of mine dewatering water to the area's surface water courses and arroyos (see Figure 1).

Murray (1945) (Ref. 1) made a reconnaissance study of ground water in the area near the town of Bluewater for irrigation and identified three primary aquifers: the basalt, the alluvium, and the Permian limestone and sandstone. The Bluewater Underground Water Basin was declared by the State Engineer on May 21, 1956 to regulate the use of ground water in the basin. Gordon (1961) (Ref. 2) conducted a detailed study of the Bluewater-Grants area to evaluate water quality, declining water levels, and the availability of ground water for future use.

In 1975 the U.S. Environmental Protection Agency (EPA) assessed the impacts of waste discharges from uranium mining and milling on ground water in the Grants Mining District with a focused sampling investigation on the Anaconda, Homestake, and Ambrosia Lake mill sites. Gallaher and Cary (1986) (Ref. 3) described regional sampling conducted by the New Mexico Environmental Improvement Division (predecessor agency of NMED) from 1977 to 1982 and assessed the impacts of the uranium industry on surface and shallow ground water.

Two inactive mill sites that processed uranium ores are located in the vicinity of the Site. They are the Anaconda Bluewater Mill (Bluewater Disposal Site) and the Homestake Mill (Homestake Mining Company (HMC) Superfund site (CERCLIS ID NMD007860935)), which began operations in the 1950s. Historical operations and previous environmental investigations at these inactive mill sites are described below. Two additional inactive uranium mills, the Phillips Mill and Rio Algom-Ambrosia Lake Mill operated north (upgradient) of the Site in the Ambrosia Lake area. These mills are not discussed in this report as they are located outside the study area.

### **Bluewater Disposal Site**

The Anaconda Copper Company constructed the uranium mill at the Bluewater site in 1953 and began processing uranium ore in limestone using a carbonate-leach system. The mill switched to an acid-leach system in 1955 to process sandstone ore from the Jackpile Mine located near Laguna, New Mexico. The mill was located northwest of the Site investigation area and approximately two miles northeast of the Village of Bluewater, New Mexico (see Figure 1). Tailings from the acid-leach process were disposed in a natural basin north of the mill in an area with geologic faults that provided conduits for tailings liquid to seep into and mix with natural ground water in the alluvial and bedrock aquifers. To reduce the amount of tailings seepage into the underlying aquifers, Anaconda disposed of tailings liquid in a deep injection well located north of the main tailings impoundment from 1960-1977. In 1977 the Atlantic Richfield Company (ARCO) purchased the Bluewater mill, and in 1978 the Uranium Mill Tailing Radiation Control Act (UMTRCA) designated the Bluewater mill as a Title II site. UMTRCA Title II sites are transferred to the federal government or state in which a mill is located for long-term management once the site remediation is deemed complete by the NRC.

Active milling of uranium ore ended in 1982 and ARCO submitted a decommissioning plan to the NRC in 1987. Surface reclamation, tailings stabilization, and decommissioning were completed in 1995, and ARCO estimated that approximately 5.7 billion gallons of tailings fluids seeped from the main tailings impoundment prior to encapsulation in 1995, with about 2.7 billion gallons occurring prior to 1960 when deep-well injection began (Ref. 4). ARCO applied to the NRC for alternate concentration limits (ACLs) for uranium in the alluvial and San Andres aquifers (0.44 mg/L and 2.15 mg/L, respectively). NRC approved ARCO's request for ACLs, deemed the site remediated, terminated the source material license, and transferred the site to the U.S. Department

of Energy (DOE) Legacy Management (LM) program for long-term monitoring and management. ARCO installed monitoring wells at the site and monitored nearby private off site wells for mill contamination during active milling and decommissioning. The DOE inherited nine of the ARCO onsite monitoring wells, which were considered to be sufficient by ARCO and NRC to ensure regulatory compliance in the alluvial and San Andres aquifers (Ref. 4).

In 2008, the New Mexico Environment Department (NMED) conducted a Site Investigation (SI) of the Bluewater Disposal Site, and the San Andres wells were sampled for an expanded list of metals and radionuclides (Ref. 5). However, laboratory results from the water samples for uranium were below detection limits. NMED subsequently reviewed well construction diagrams and sampling protocol for representative sampling and determined that the sampling results for uranium were suspect and not representative of the true ground water quality of the San Andres Aquifer beneath the site. Groundwater quality issues led the DOE to install and sample six new San Andres aquifer wells and four new alluvial wells from 2011 through 2012 in order to gain a better understanding of the hydrogeology and geochemistry of groundwater at the site (Ref. 4).

In 2014, DOE conducted a study to develop a groundwater conceptual model that describes the extent of contamination associated with the Bluewater site and the potential risk to downgradient groundwater users. The DOE completed a *"Site Status Report on the Flow and Contaminant Transport in Vicinity of the Bluewater New Mexico, Disposal Site"* in November 2014 (Ref. 4). DOE determined that contamination in the alluvial aquifer was exceeding the uranium standard (0.44 mg/L) at the Point of Compliance well T(M) since January 2011 (Ref. 4, Figure 54), and that contaminated San Andres aquifer groundwater extends beyond the site boundaries (Ref. 4, Figure 63). Based on a limited sampling of wells south and east of the site, the uranium levels in private well water do not exceed the federal drinking water maximum contaminant level (MCL) of 0.030 mg/L (Ref. 4, Figure 63).

The DOE's 2014 site status report indicates that uranium contamination in the San Andres aquifer has migrated eastward from the Bluewater site to the HMC site (Ref. 4, Figure 63), and possibly that uranium-contaminated San Mateo Creek alluvial groundwater has migrated southward and impacted the northwestern-most municipal well (Milan Well #4) through vertical migration by pumping groundwater from the San Andres aquifer (Ref. 4, Table 17).

### **Homestake Mining Company Superfund Site**

The HMC uranium mill opened in 1958 and is located 5.5 miles north of the Village of Milan, New Mexico. Milling operations began at Homestake mill site in 1958 and continued for approximately 30 years until 1990. The milling operations involved the use of an alkaline leach caustic precipitation process to extract and concentrate uranium oxide from ores with average grades of 0.05 to 0.30 percent uranium oxide. The milling process byproducts (waste) were placed in two tailings piles onsite. The first Small Tailing Pile (STP) contains approximately 1.2 million tons of tailings from ore milled under contracts with the federal government. The second Large Tailings Pile (LTP) contains approximately 21 million tons of tailings from ore milled under both federal government and commercial contracts (Ref. 6).

HMC began a state-approved ground water restoration program in 1977 under Discharge Permit No. 200 (DP-200). The program consists of a groundwater collection/injection system for the San

Mateo alluvial aquifer and the Upper and Middle Chinle aquifers. The objective is to reduce contaminant concentrations to background concentrations.

In September 1983, EPA placed the HMC Superfund site on the National Priorities List (NPL), because of radon contamination in air associated (emanating from) with the tailings. Further investigations at the site identified groundwater contamination in onsite monitoring wells and some nearby residential wells. HMC and the EPA signed a consent decree in December 1983.

The consent decree required HMC to provide an alternate water supply to nearby residences and to pay for water usage for 10 years. The alternate water supply connections to residences were completed in April 1985, with HMC paying for water usage until 1995 (Ref. 7). The Record of Decision (ROD) for the HMC site does not include a remedy for groundwater (Ref. 8).

Under a Memorandum of Understanding between the NRC and the EPA [59 FR 3740] effective December 14, 1993, the NRC has primary federal regulatory authority over ongoing surface reclamation and groundwater remediation through administration of HMC's corrective action program (last revised in March 2012) through NRC Source Materials License SUA-1471 (last amended July 19, 2013 [amendment 47]), while the EPA has review and oversight authority over these activities. NMED regulates site activities relating to groundwater abatement and closure activities under DP-200. HMC renewed DP-200 for the treatment and discharge to 7,920,000 gallons per day (or 5,500 gallons per minute, gpm) of contaminated groundwater. The discharges are associated with ongoing groundwater abatement activities for contamination originating from former uranium milling activities. Impacted groundwater exceeds the groundwater quality standards for contaminants that include nitrate, selenium, uranium, radium (radium-226 plus radium-228), chloride, sulfate, molybdenum, and total dissolved solids (Ref. 9).

In September 2005, NMED and EPA conducted a well survey in the residential subdivisions south of the mill site to verify that residents were not being exposed to contaminated well water. The agencies collected samples from 34 private water supply wells. The samples were analyzed for EPA's target analyte list of compounds and radionuclides. In November 2005, EPA Region 6 contacted the Agency for Toxic Substances and Disease Registry (ATSDR) and requested that ATSDR review the results and determine whether a public health hazard exists. Additional sampling was conducted in 2006 and 2007, and NMED issued a final report in 2007 (Ref. 10).

In June 2009, ATSDR published a Health Consultation Report based on their review of the water supply well sample data. ATSDR calculated exposure doses for the contaminants above health comparison values and EPA drinking water maximum contaminant levels (MCLs) in well sample results and determined that those being used as a source of potable water were not at levels that would produce known adverse health effects. The report did identify a few wells that have uranium concentrations well above the background concentration that were not being used and recommended that they should not be used (Ref. 11).

The NMED, EPA, and the NRC collaborated to conduct well data collection and sampling activities in August and September 2005, and May and August 2006 to determine the number of residential wells in which groundwater does not meet applicable federal, state, and site groundwater standards. NMED conducted a SI for the Anaconda Bluewater Disposal Site in 2008

(CERCLIS ID NMD007106891) (Ref. 5) and another SI for the upper San Mateo Creek Basin in 2009 (CERCLIS ID NMN00060684) (Ref. 12).

### **3 Site Investigation**

#### **3.1 Source/Waste Characteristics and Description**

The source(s) of contamination to groundwater in the lower SMC basin includes tailings seepage from the Bluewater Disposal Site and the HMC Superfund site. Additional potential sources include the two Ambrosia Lake area mill sites (Phillips Disposal site and Rio Algom Mill site) and the former legacy uranium mine dewatering discharges in the upper SMC basin may also have contributed to groundwater contamination in the lower SMC basin.

The HMC tailings piles are the closest known source of groundwater contamination from the seepage and infiltration into the alluvium and upper two zones of the Chinle Formation. Beginning in the early 1960s, the mill tailings were placed on the land surface of the San Mateo Creek alluvium without an engineered liner. Contamination from the tailings seepage subsequently infiltrated into the alluvial and Chinle aquifers, moving beyond the facility property boundaries, and into the groundwater that originally supplied potable water to nearby private residential and irrigation wells.

Site standards for remediation of the groundwater at the HMC Superfund site were established in 2006 using data from 1995 to 2004, and they were incorporated into the NRC license SUA-1471 under Amendment No. 39 as Groundwater Protection Standards (Ref. 13). Site standards that have been established for the alluvial aquifer include ten water quality constituents (i.e. contaminants of concern): selenium, uranium, molybdenum, sulfate, chloride, total dissolved solids (TDS), nitrate, vanadium, thorium-230, and radium-226/228. Site standards that have been established for the Chinle aquifers include eight water quality constituents: selenium, uranium, molybdenum, sulfate, chloride, TDS, nitrate, and vanadium.

Other sources of contamination that have not been adequately characterized include the mine dewatering discharges that occurred in the upper reaches of the SMC basin.

##### **3.1.1 Source Waste Characterization Methods and Results**

Groundwater monitoring at the HMC Superfund site began in 1975 to characterize the contaminant plume, to evaluate the performance of the restoration strategies, and to demonstrate progress made in restoring groundwater quality to meet site standards (Ref. 14). To date, HMC has drilled nearly 700 wells in the three main aquifer units to investigate releases from the mill and tailings area. HMC currently samples approximately 80 wells on a quarterly or semi-annual basis to meet NRC license and NMED permit requirements, and voluntarily samples several hundred additional wells to assess the performance of the restoration strategies and any changes in the groundwater plumes in the alluvial aquifer and upper two units of the Chinle aquifer (Ref. 6). Annual monitoring reports are submitted to the NRC and placed on the publically available NRC Agency Wide Access and Management System (ADAMS) website at <http://www.nrc.gov/reading-rm/adams.html>.

## 4 Groundwater Pathway

The groundwater pathway assesses the threat to human health and the environment by determining whether hazardous substances are likely to have been released to groundwater and whether any receptors (via drinking water wells, wellhead protection areas, resources) are likely to be exposed to hazardous substances as a result of a release.

### 4.1 Groundwater Use

According to the New Mexico Drinking Water Bureau, Safe Drinking Water Information System (SDWIS) database, there are three active municipal water supply wells managed by the Village of Milan that serve approximately 2,000 people located in the lower SMC basin.

The New Mexico Office of the State Engineer (OSE) maintains a Water Rights Reporting System (NMWRRS) containing water rights and well information for wells in the Bluewater Basin-Milan, New Mexico area. The NMWRRS is available via the website at <http://nmwrrs.ose.state.nm.us/nmwrrs/index.html>. According to the NMWRRS database, there are 861 permit records within the lower SMC basin. Of these, over 600 of the records are associated with groundwater monitoring and operations at the HMC Superfund site.

Figure 2 shows the locations of registered public water supply and private/residential wells within the lower SMC basin. Table 1 summarizes the well usage within the lower SMC basin.

### 4.2 Regional Hydrogeology

Groundwater in the area around the Homestake site is the result of two intersecting flow systems: 1) groundwater from the upgradient Bluewater Disposal site generally flows from west to east toward the Homestake mill site; and 2) groundwater from Lower San Mateo Creek flows generally down gradient to the south and east toward the Rio San Jose surface water channel (Ref. 15 and Ref. 16). Within the Site investigation area, three aquifer systems result from the two intersecting flow systems and are of concern for groundwater contamination. The upper most aquifer system is the San Mateo Creek alluvial aquifer which is located within the areas of alluvial fill deposited in the erosional surfaces of the Chinle Formation. The underlying (middle) system is comprised by units of the sandstone and shales of the Chinle Formation identified as the Upper, Middle, and Lower Chinle aquifers. Beneath the Chinle Formation is the San Andres Glorieta Sandstone Formation (lower most aquifer) which is predominantly a limestone and sandstone unit. The San Andres Limestone-Glorieta Sandstone is the primary regional aquifer used by the communities of Bluewater, Milan, and Grants for their current and long-term potable water supply. Figure 3 shows the general groundwater flow directions of the alluvial aquifer and San Andres aquifer in the lower SMC basin.

Groundwater elevations, gradients, hydraulic properties, and flow directions for the three aquifer units are extremely variable and complex due to natural conditions and the ongoing HMC groundwater extraction, injection, and treatment systems that operate to control plume migration and restore impacted groundwater to back groundwater quality standards. Structurally, the lower Site investigation area is characterized by two normal faults (East Fault and West Fault) that generally bound the east and west sides of the San Mateo Creek alluvial channel. Bedrock formations dip gently to the east and northeast. Generally speaking, groundwater in the unconfined

alluvial aquifer flows southwest toward the Rio San Jose drainage and groundwater in the Chinle and San Andres-Glorieta flows northeast toward the axis of the San Juan Basin. There is hydraulic communication between the alluvium and the Chinle depending on factors such as the proximity to faults, erosional contact, and recharge areas.

The Quaternary-age alluvial (Qal) aquifer has an average saturated thickness of approximately 95 feet near HMC, while in other areas the alluvial aquifer are completely unsaturated. Groundwater elevations in the alluvial aquifer range from approximately 6,427 to 6,604 feet above mean sea level (MSL). North of the HMC Superfund site, the hydraulic gradient in the alluvial aquifer is approximately 0.0033 feet/feet (ft/ft). There is limited hydraulic communication between the alluvial and Chinle aquifers depending on factors such as the proximity to faults, erosional contact, and recharge areas.

The Triassic-age Chinle Formation (Trc) underlies the alluvium and reaches a maximum thickness of 850 feet in the Site investigation area. The Chinle Formation is comprised of the Upper, Middle, and Lower aquifers consisting of interbedded sandstones, siltstones, and shales that are generally low in permeability and transmissivity of groundwater.

The Chinle Formation generally behaves as a low yield, semi-confined aquifer system, although some sandstone beds can produce fair to moderate amounts of water to private residential and small irrigation wells. The average thickness of the Upper Chinle aquifer is 35 feet and the general groundwater flow direction is from north to south. Groundwater elevations in the Upper Chinle range from 6,456 to 6,540 feet above MSL. The Middle Chinle aquifer has an average saturated thickness of 44 feet in the area around the HMC Superfund site. Groundwater elevations in the Middle Chinle aquifer range from 6,438 to 6,541 feet above MSL. The Lower Chinle aquifer behaves as a confined aquifer system due to a shale aquitard although secondary permeability is developed from fractures or other physical alteration. Groundwater elevations in the Lower Chinle range from 6,426 to 6,488 feet above MSL.

The Permian-age San Andres (Psa) aquifer exceeds a thickness of 200 feet in the lower SMC basin. The hydraulic gradient is approximately 0.00086 ft/ft and groundwater elevations range from 6,420 to 6,433 feet above MSL. The San Andres Limestone yields high volumes of groundwater to a well because of the dissolution along fractures and karst nature of the limestone. The San Andres Limestone is the primary regional aquifer used by the communities of Bluewater, Milan, and Grants for their potable water supply.

#### **4.3 Local Groundwater Quality**

Contaminant releases to the alluvial aquifer are indicated by the presence of elevated concentrations of selenium, uranium, molybdenum, sulfate, chloride, total dissolved solids (TDS), nitrate, vanadium, thorium-230, and radium-226/228. Contamination of the alluvial and Chinle aquifers from mill tailings seepage at the HMC mill site was first detected in the 1960s/1970s. Subsequently, several of the nearby residential wells producing water from the alluvial and Chinle aquifers for domestic, agriculture, and livestock usage became contaminated with HMC mill tailings seepage water.



Private well owners whose water quality has been compromised by groundwater contaminants were provided with an alternative potable water supply connection to the Village of Milan municipal water supply system which produces water from the San Andres aquifer.

HMC began monitoring of the near upgradient alluvial aquifer background water quality in 1976 and the far up-gradient alluvial background water quality in 1994. The major cation in alluvial background water is sodium and the major anion is sulfate. The background alluvial water quality is considered to be "brackish" with TDS concentrations greater than 1,000 mg/L.

In the lower SMC basin area, the Upper Chinle aquifer is characterized by sodium as the major cation, and either bicarbonate or sulfate as the major anion depending on the location. The Upper Chinle aquifer water quality is similar to the alluvial aquifer water quality where the two units are in hydraulic communication within sub-crop areas. The area where the Upper Chinle and alluvial aquifers are in hydraulic communication has resulted in a "mixing zone" between the two aquifers. The Middle Chinle aquifer also has a mixing zone where alluvial aquifer water has been impacted in sub-crop areas where mill tailings seepage has migrated and mixed with the Middle Chinle groundwater. The natural water composition of the Lower Chinle aquifer is variable and reflects the limited permeability and lower transmissivity of the shale in this unit.

Based on water sample laboratory results from the NMED Bluewater SI in 2008, groundwater from the San Andres-Glorieta Aquifer is typically a calcium-sulfate/bicarbonate type of water, and sodium concentrations are lower relative to calcium concentrations. The San Andres aquifer is not known to be contaminated with mill tailings seepage from the HMC Superfund site, but may be contaminated with mill tailings seepage from the Bluewater Disposal site. The downgradient extent of the contaminant plume at the Bluewater Disposal site is known to be at or beyond the southern and eastern property boundaries of the Bluewater Disposal site. The DOE is currently sampling onsite monitoring wells on a semi-annual basis and nearby off-site private wells as appropriate.

#### **4.4 Non-Sampling Data Acquisition**

NMED conducted a survey of water use at private well locations as part of the process included in this SR. An initial list of private well locations and well owner contact information for proposed sampling under this SR was provided to NMED in early 2014 from the EPA. Additional wells were added to the list as information became available. NMED mailed 41 water use survey forms to private well owners in June 2014. The water use forms were used to establish information on the existence, current operational status and use of the wells. Based on the results of the survey a number of residents continue to use their wells for non-drinking purposes including bathing, washing vehicles, livestock watering, and seasonal gardening. NMED followed up the survey by mailing out access forms to allow NMED access to collect samples from the wells. Private well use surveys, NMWRRS information, and well records (if available) are provided in Attachment A.

Based on the well survey and access agreements received, 58 wells/sampling locations were originally proposed in the SI work plan (Ref. 17) and 23 wells were actually sampled in October 2014. Other wells were either inaccessible or inoperative. Three additional wells (LSM-60, LSM-61, and LSM-62) were sampled in January 2015.

## **4.5 Sampling Activities**

In accordance with the SI work plan dated September 2014, NMED sampled groundwater from private residential and public water supply wells that were completed in three primary aquifers (alluvial, Chinle Formation, and San Andres) to assess groundwater quality across the Site. Table 2 summarizes the laboratory analyses for general chemistry, total and dissolved metals, and radiochemistry. Figure 4 shows the groundwater sampling locations Site-wide and their subdivision into upper, middle, and lower investigation areas.

In general, groundwater samples from private wells and municipal water supply wells were collected at the in-line valves/spigots between the wellhead and treatment/purification systems; otherwise, at wells with no purification system, samples were collected directly from the nearest spigot to the well. Private supply wells were purged a minimum of 15 minutes to ensure stagnant water within the discharge pipeline and pressure tank was purged prior to sampling.

Well locations without a dedicated pump were sampled using a portable submersible pump. One groundwater sample (LSM-41) was collected from an irrigation well (B-5) that was in the process of plugging and abandonment by a local drilling contractor. Sample LSM-41 was collected from a portable submersible pump supplied by the drilling contractor.

Prior to sampling, wells were purged for at least 15 minutes or until field water quality parameters including pH, conductivity, and temperature which were monitored during purging, had stabilized ( $\pm 0.10$  for pH,  $\pm 3\%$   $\mu\text{S}/\text{cm}$  for conductivity and  $\pm 1$  degree C for temperature) and groundwater samples were collected. Field parameters were measured using a Yellow Springs Instruments (YSI) Model 556 multi-probe instrument for pH, conductivity, dissolved oxygen, and temperature. A separate turbidity meter was used to record turbidity measurements. The water quality meters were checked and calibrated prior to sampling in accordance with the manufacturer's instructions.

All samples collected in this program utilized chain-of-custody handling and documentation procedures according to the NMED-GWQB Quality Management Plan (QMP) and NMED-SOS Quality Assurance Project Plan (QAPP) dated March 2014 (Ref. 18 and Ref. 19), and the SI work plan dated September 2014 (Ref. 17). Samples were collected in the appropriate containers with preservatives, placed in insulated coolers with ice, and shipped to the laboratories within the specified analytical holding times. All samples were screened with a Ludlum Model 14C Survey Meter (rate meter) and a Ludlum Model 44-9 alpha, beta, gamma detector using at least a 60 second count on the surface of the sample container prior to packaging and shipment to the laboratory.

## **4.6 Analytical Results**

Twenty-eight groundwater samples (including two field duplicates) were analyzed by EPA certified laboratories. Table 3 summarizes the groundwater investigation results and compares these results to the EPA MCLs and NMWQCC groundwater standards.

### **4.6.1 General Chemistry**

Analytical results were reported for 18 general chemistry parameters, including anions such as, chloride (Cl), carbonate ( $\text{CO}_3$ ), bicarbonate ( $\text{HCO}_3$ ), and sulfate ( $\text{SO}_4$ ); and cations such as, dissolved calcium (Ca-diss), dissolved sodium (Na-diss), dissolved potassium (K-diss), and

dissolved magnesium (Mg-diss). Trilinear/radial diagrams and stiff diagrams were used to evaluate major ion associations and characterize the sample water-types and spatial changes in general water chemistry across the Site.

Figures 5 through 11 present data summary tables, radial diagrams, and stiff diagrams that illustrate the spatial variation in general water chemistry across the Site, as divided into the upper, middle, and lower basin areas, respectively (see Figure 4).

Based on the general chemistry results (summarized in Table 3), parameters that were contaminants of concern detected in the samples analyzed are chloride, nitrite and nitrate (NO<sub>2</sub>+NO<sub>3</sub>), sulfate (SO<sub>4</sub>), and total dissolved solids (TDS). Nitrate and nitrite concentrations (detected) range from 0.58 mg/L to 17.2 mg/L, with the maximum concentration detected in sample LSM-56, collected from an alluvial well located in the upper basin area (see Figure 5). Sulfate concentrations range from 80 mg/L to 2,380 mg/L, with the maximum concentration detected in sample LSM-56, in the upper basin area (see Figure 5). TDS concentrations range from 322 mg/L to 3,930 mg/L, with the maximum concentration detected in sample LSM-52, collected from an alluvial well located south of the HMC Superfund site in the lower basin area (see Figures 9 and 10). Twenty-seven of 28 samples exceed either the EPA MCLs and/or NMWQCC groundwater standards for one or more of these general chemistry parameters.

Chloride was detected in three samples (LSM-7, LSM-52, and LSM-60 at concentrations of 476 mg/L, 567 mg/L, and 444 mg/L, respectively), that exceed the NMWQCC standard (250 mg/L). Sample LSM-7 was collected from a San Andres aquifer well located in the middle basin area of the Site (see Figure 7). Samples LSM-52 (Qal) and LSM-60 (Trc) were collected from wells located south of the HMC Superfund site in the lower basin area (see Figures 9 and 10).

In general, sulfate and TDS concentrations are greater in samples collected from the alluvial wells across the Site. The major cation in the alluvial groundwater is sodium and the major anion is sulfate as illustrated by the stiff diagrams (see Figures 8 and 11). Dissolved calcium is another cation that was detected at elevated concentrations (478 to 510 mg/L) in samples LSM56 and LSM-62, from alluvial wells located in the upper basin area (see Figure 6).

In the lower basin area, the general chemistry of the Upper Chinle aquifer is characterized by sodium as the major cation, and either bicarbonate or sulfate as the major anion depending on the location (see Figure 11). The Upper Chinle aquifer (Trc) water quality is similar to the alluvial aquifer (Qal) water quality where the two units are hydraulically connected in sub-crop areas.

Across the Site, the general chemistry of the San Andres aquifer is typically a sodium and bicarbonate-type of groundwater, with higher dissolved calcium and sulfate concentrations relative to sodium and bicarbonate concentrations in samples collected from up-gradient wells located in the southwestern extent of the lower basin area (see Figure 11).

#### **4.6.2 Radiochemistry**

Analytical results were reported for 16 radiological parameters, including uranium isotopes such as, uranium-234 (U-234) and uranium-238 (U-238); and gross alpha with natural uranium (Unat)

reference. Trilinear/radial diagrams and stiff diagrams were used to evaluate the relative proportions of U-234 to U-238, and gross alpha (U-nat) concentrations across the Site.

Figures 12 through 15 present data summary tables and radial diagrams that illustrate the spatial variation in radiochemistry across the Site, as divided into the upper, middle, and lower basin areas, respectively (see Figure 4).

Based on the radiochemistry results (summarized in Table 3), U-238 was detected at concentrations that range from 0.27 pCi/L to 60.2 pCi/L. Eleven of 28 samples exceed the EPA MCL (10 picocuries per liter (pCi/L) for U-238. U-234 was detected at concentrations that range from 2.1 pCi/L to 75.2 pCi/L; however, neither EPA MCLs and/or NMWQCC groundwater standards have been established for U-234. Gross alpha (U-nat) was detected at concentrations that range from 3.6 pCi/L to 116.9 pCi/L. Fourteen of 28 samples exceed the EPA MCL (10 pCi/L) for gross alpha (U-nat). Although radium-226 was identified as a human-health risk under the soil exposure pathway (Section 6.1), it was not detected at concentrations above the EPA MCL (5 pCi/L) in the 28 groundwater samples analyzed.

Maximum concentrations of U-238, U-234, and gross alpha (U-nat) were detected in samples LSM-34 and LSM-52 collected from alluvial wells located in the middle and lower basin areas (see Figures 13 and 14). U-238 was detected at concentrations of 60.2 pCi/L and 58.2 pCi/L, respectively. U-234 was detected at concentrations of 75.2 pCi/L and 69.5 pCi/L, respectively. Gross alpha (U-nat) was detected at concentrations of 116.9 pCi/L and 108.2 pCi/L, respectively.

Uranium mass (U-mass) was detected at concentrations that range from 4 micrograms per liter ( $\mu\text{g/L}$ ) to 210  $\mu\text{g/L}$ . Twelve of 28 samples exceed the EPA MCL (30  $\mu\text{g/L}$ ) for U-mass.

Maximum U-mass concentrations were detected in samples LSM-34 and LSM-52 (210  $\mu\text{g/L}$  and 200  $\mu\text{g/L}$ , respectively) collected from alluvial wells located in the middle and lower basin areas (see Figures 13 and 14).

In general, uranium and gross alpha (U-nat) concentrations are greatest in seven samples (LSM32, LSM-49, LSM-50, LSM-51, LSM-52, LSM-53, and LSM-60) collected from alluvial and Chinle aquifer wells located hydraulically down-gradient of the HMC Superfund site in the lower basin area, which is likely the result of contaminant releases associated with seepage from the large tailings pile onsite. The Upper Chinle aquifer (Trc) radiochemistry is similar to the alluvial aquifer (Qal) where the two units are hydraulically connected in sub-crop areas.

The elevated radionuclide concentrations detected in samples LSM-34 (Qal) and LSM-36 (Trc) in the middle basin area, in addition to, samples LSM-58 (Jmw) and LSM-61 (Jmw) in the upper basin area, may be the result of impacts by up-gradient source(s) of contamination to groundwater such as the former Ambrosia Lake area mill sites (United Nuclear Corporation Phillips Disposal site and Rio Algom Mill site), and former uranium mine dewatering discharges in the upper SMC basin.

### 4.6.3 Total and Dissolved Metals

Analytical results were reported for 26 total metals and 26 dissolved metals, however, only arsenic, selenium, and uranium exceed MCLs or NMWQCC standards and are discussed in this report. Analytical results for total metals were compared to the EPA MCLs and dissolved metals were compared to the NMWQCC standards. Figures 16 through 18 present data summary tables that illustrate the spatial variation for arsenic, selenium, and uranium across the Site, as divided into the upper, middle, and lower basin areas, respectively (see Figure 4).

Based on the total and dissolved metals results (see Table 3), total and dissolved uranium were detected at concentrations that range from 0.006 mg/L to 0.24 mg/L. Twelve of 28 samples exceed both the EPA MCL and/or NMWQCC groundwater standard for total uranium (0.03 mg/L) and dissolved uranium (0.03 mg/L). Total and dissolved uranium concentrations are greatest in seven samples (LSM-32, LSM-49, LSM-50, LSM-51, LSM-52, LSM-53, and LSM60) collected from alluvial and Chinle aquifer wells located hydraulically down-gradient of the HMC Superfund site in the lower basin area, which is likely the result of contaminant releases associated with seepage from the large tailings pile onsite. The Upper Chinle aquifer (Trc) radiochemistry is similar to the alluvial aquifer (Qal) where the two units are hydraulically connected in sub-crop areas. The maximum concentrations of total and dissolved uranium were detected in samples LSM-34 and LSM-52 (0.24 mg/L and 0.228 mg/L, respectively) collected from alluvial wells located in the middle and lower basin areas (see Figures 17 and 18).

Selenium concentrations ranged from 0.004 mg/L to 0.658 mg/L with 3 samples (LSM-34, LSM-52, and LSM-61) exceeding both the EPA MCL and NMWQCC groundwater standard for total selenium (0.05 mg/L) and dissolved selenium (0.05 mg/L). The maximum concentrations of total and dissolved selenium were detected in samples LSM-34 and LSM-52 (0.658 mg/L and 0.252 mg/L, respectively).

Arsenic concentrations range from 0.0021 mg/L to 0.0349 mg/L with 3 samples (LSM-34, LSM36, and LSM-52) exceeding the EPA MCL for total arsenic (0.01 mg/L). The maximum concentrations of total arsenic were detected in samples LSM-34 and LSM-52 (0.0349 mg/L and 0.0161 mg/L, respectively) collected from alluvial wells located in the middle and lower basin areas (see Figures 17 and 18).

### 4.6.4 Comparison to Historical Data

Analytical results for general chemistry, radiochemistry, and metals for four groundwater samples (LSM-34, LSM-35, LSM-56, and LSM-61) were compared to the historical data for four samples (SMC-13, SMC-10, SMC-25, and SMC-20) collected from the same wells during the SMC SI in 2009 (Ref. 12). Table 4 provides a comparison of the contaminants detected in these groundwater samples.

The analytical results for general chemistry parameters (nitrate/nitrite, sulfate, and TDS), uranium isotopes (U-234 and U-238), and total and dissolved metals (selenium and uranium) for two of the four sample pairs (SMC-13/LSM-34 and SMC-20/LSM-61) are very similar, especially considering the five-year span between sampling events. However, the results for the other two sample pairs (SMC-10/LSM-35 and SMC-25/LSM-56) were dissimilar (greater than two times).

for the general chemistry parameters. Additional groundwater sampling of these specific wells would be needed to evaluate contaminant trends over time.

## **5 Surface Water Pathway**

The surface water pathway assesses the threat to human health and the environment by determining whether hazardous substances are likely to have been released to surface water; and whether any receptors (via intakes supplying drinking water, fisheries, sensitive environments) are likely to be exposed to a hazardous substance as a result of a release.

### **5.1 Surface Water Investigation**

No data acquisition was performed for the evaluation of the surface water pathway. Furthermore, the surface water pathway was not evaluated under EPA's human health risk assessment (HHRA) completed in December 2014 (Ref. 20).

## **6 Soil Exposure Pathway**

The soil exposure pathway assesses the threat to human health and the environment by direct contact with hazardous substances and areas of suspected contamination. This pathway addresses any material containing hazardous substances that is on or within 2 feet of the surface and not capped by an impermeable cover.

### **6.1 Soil Exposure Investigation**

No data acquisition was performed for the evaluation of the soil exposure pathway. However, EPA's HHRA evaluated the soil exposure pathway using a residential scenario (for individuals living in the five subdivisions south of HMC) that assumes exposure to soil through the incidental soil ingestion route, external exposure to gamma radiation, inhalation of radionuclides in airborne particulates, and ingestion of produce (vegetables and fruits) modeled through the uptake of radionuclides in soil into plants. The risk was primarily due to external exposure to radium-226+D (Ra-226 plus daughter products) where the site-related life-time excess cancer risk was estimated at  $6.0 \times 10^{-5}$  (Ref. 20, Table 5-3).

## **7 Air Pathway**

The air pathway assesses the threat to human health and the environment by determining whether hazardous substances are likely to have been released to the air; and whether any receptors (human population and sensitive environments) are likely to be exposed to hazardous substances as a result of a release.

### **7.1 Air Quality Investigation**

No data acquisition was performed for the evaluation of the air pathway. However, EPA's HHRA evaluated the air pathway using a residential scenario (for individuals living in the five subdivisions south of HMC) that assumes exposure to contaminants in air through the inhalation and submersion routes of intake. The risk was primarily due to inhalation of radon-222+D (Rn222 plus daughter products) in ambient air where the site-related life-time excess cancer risk was estimated at  $5.0 \times 10^{-4}$  (Ref. 20, Table 5-3).

## **8 Summary and Conclusions**

Potential source(s) of contamination to groundwater in the lower SMC basin include tailings seepage from the Bluewater Disposal Site and the HMC Superfund site. Other potential sources include the two Ambrosia Lake area mill sites (Phillips Disposal site and Rio Algom Mill site) as well as former legacy uranium mine dewatering discharges in the upper SMC basin that may also have contributed to groundwater contamination in the lower SMC basin.

The HMC large tailings pile is the closest known source of groundwater contamination due to seepage and infiltration of mill tailings liquids into the alluvium and upper two zones of the Chinle Formation. Contaminants of concern that have been identified in groundwater samples from monitoring wells at the HMC Superfund site and in down-gradient private supply wells include: selenium, uranium, molybdenum, sulfate, chloride, TDS, nitrate, vanadium, thorium-230, and radium-226/228.

In general, uranium and gross alpha concentrations are greatest in samples collected from alluvial and Chinle aquifer wells located hydraulically down-gradient of the HMC Superfund site in the lower basin area, which is likely the result of contaminant releases associated with seepage from the large tailings pile onsite. The Upper Chinle aquifer radiochemistry is similar to the alluvial aquifer where the two units are hydraulically connected in sub-crop areas. A total of 7 wells in the lower basin below the HMC had elevated radiological and uranium concentrations.

Elevated radionuclide concentrations detected in alluvial aquifer in the middle and upper basin areas, may be the result of impacts by up-gradient source(s) of contamination to groundwater such as the former Ambrosia Lake area mill sites and former legacy uranium mine dewatering discharges in the upper SMC basin. A total of 4 wells had elevated radiological and uranium concentrations.

In the lower SMC basin area, private well owners whose water quality has been compromised by groundwater contaminants were provided with an alternative potable water supply connection to the Village of Milan municipal water supply system which produces water from the San Andres aquifer. In the upper and middle SMC basin areas, private well owners whose water quality exceeds the federal drinking water MCLs are located in rural areas of the SMC basin where public water supply connections are not available. Point-of-use water treatment systems (i.e. reverse osmosis) would be an alternative to a public water supply connection to insure the protection of human health for these residents.

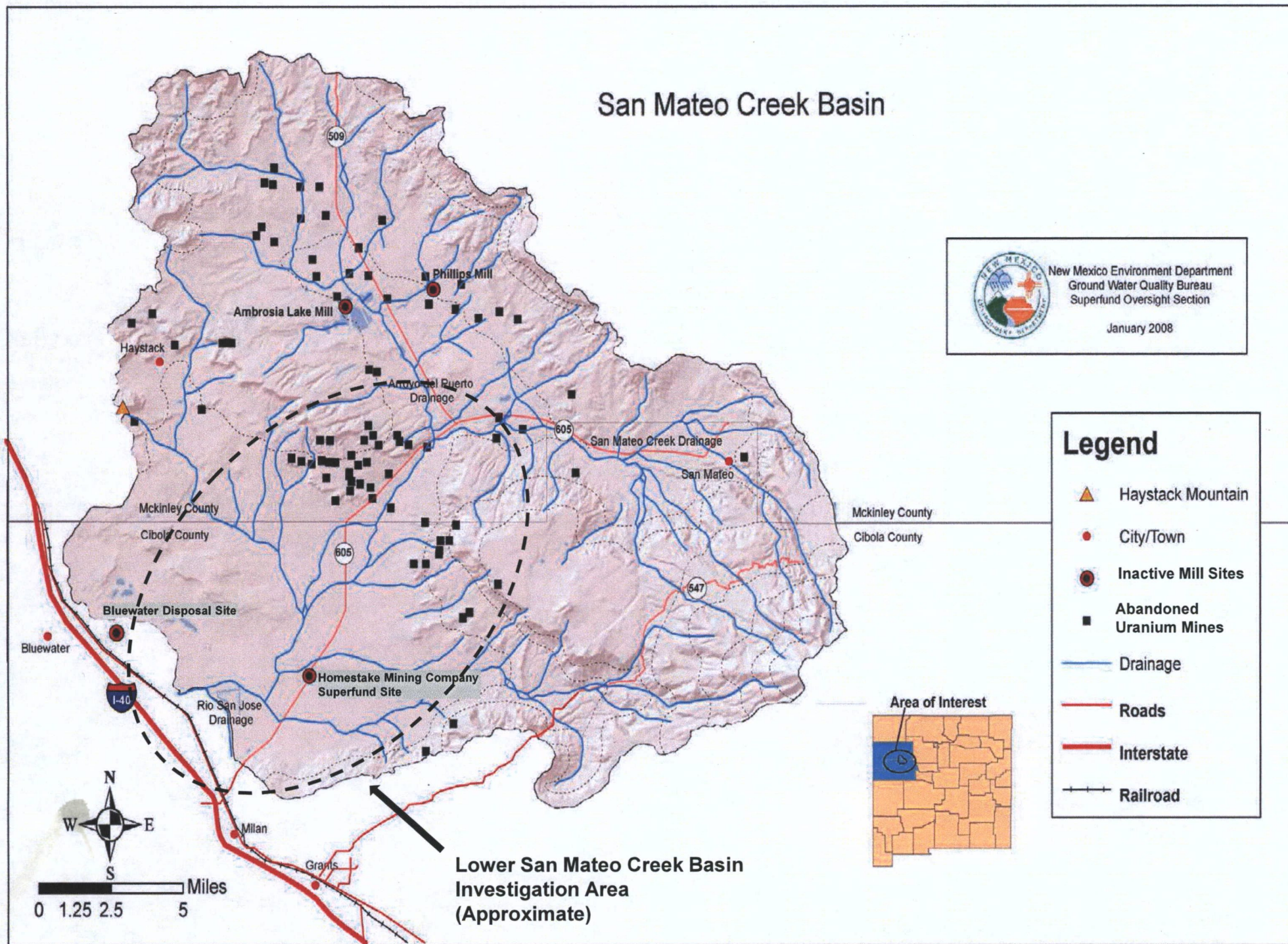
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## Figures



**Figure 1: Site Reassessment Investigation Area in the San Mateo Creek Basin**



# San Mateo Creek Basin Legacy Uranium Sites Cibola and McKinley Counties New Mexico

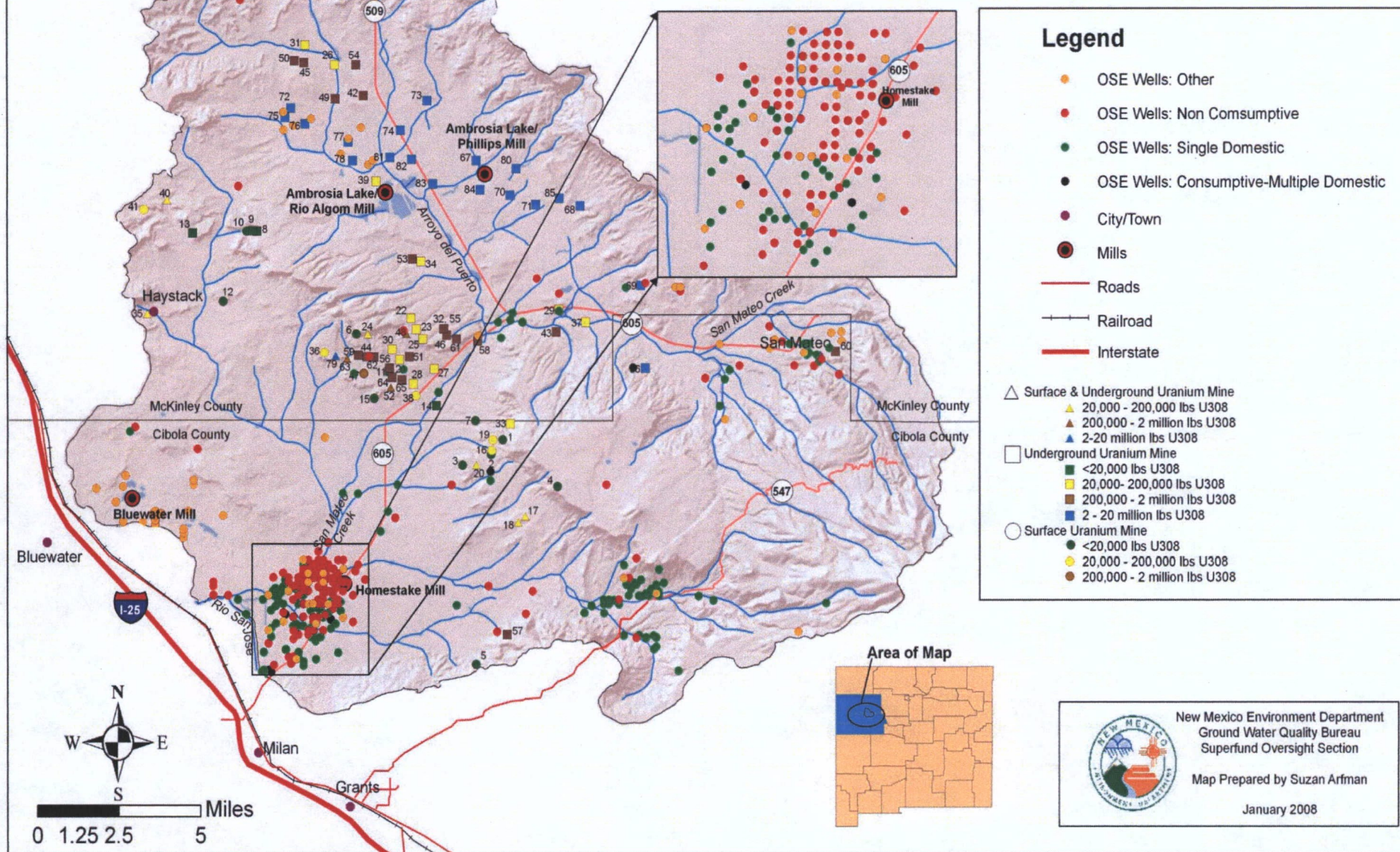
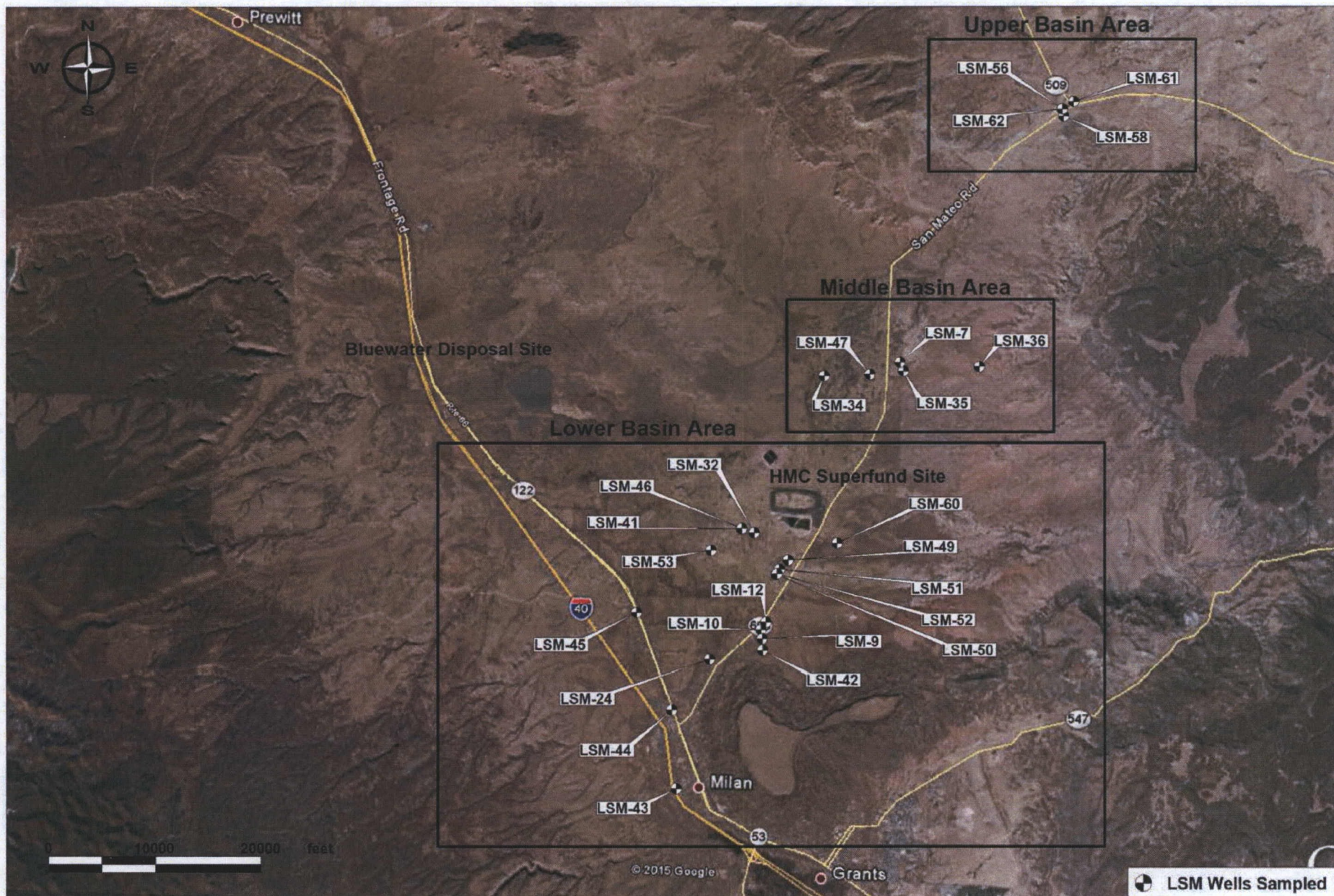


Figure 2: Registered Wells in the San Mateo Creek Basin





**Figure 4**

**Ground Water Sampling Locations - Sitewide**

Lower San Mateo (LSM) Creek Basin Wells Sampled: 2014-2015

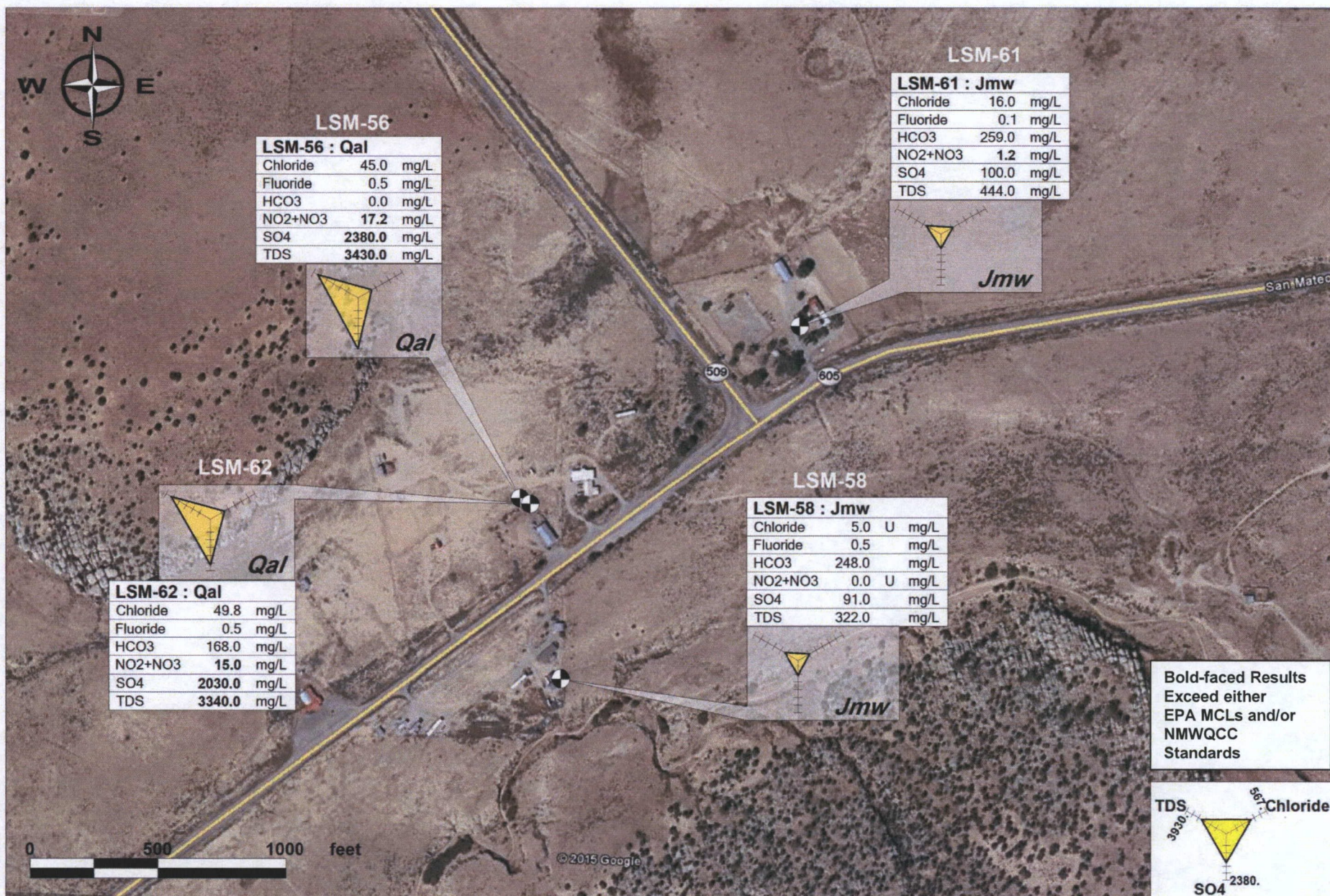


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**Figure 5**

**General Chemistry Results - Data Tables & Radial Diagrams**  
**Alluvial & Morrison/Westwater Aquifer Wells - Upper Basin Area**



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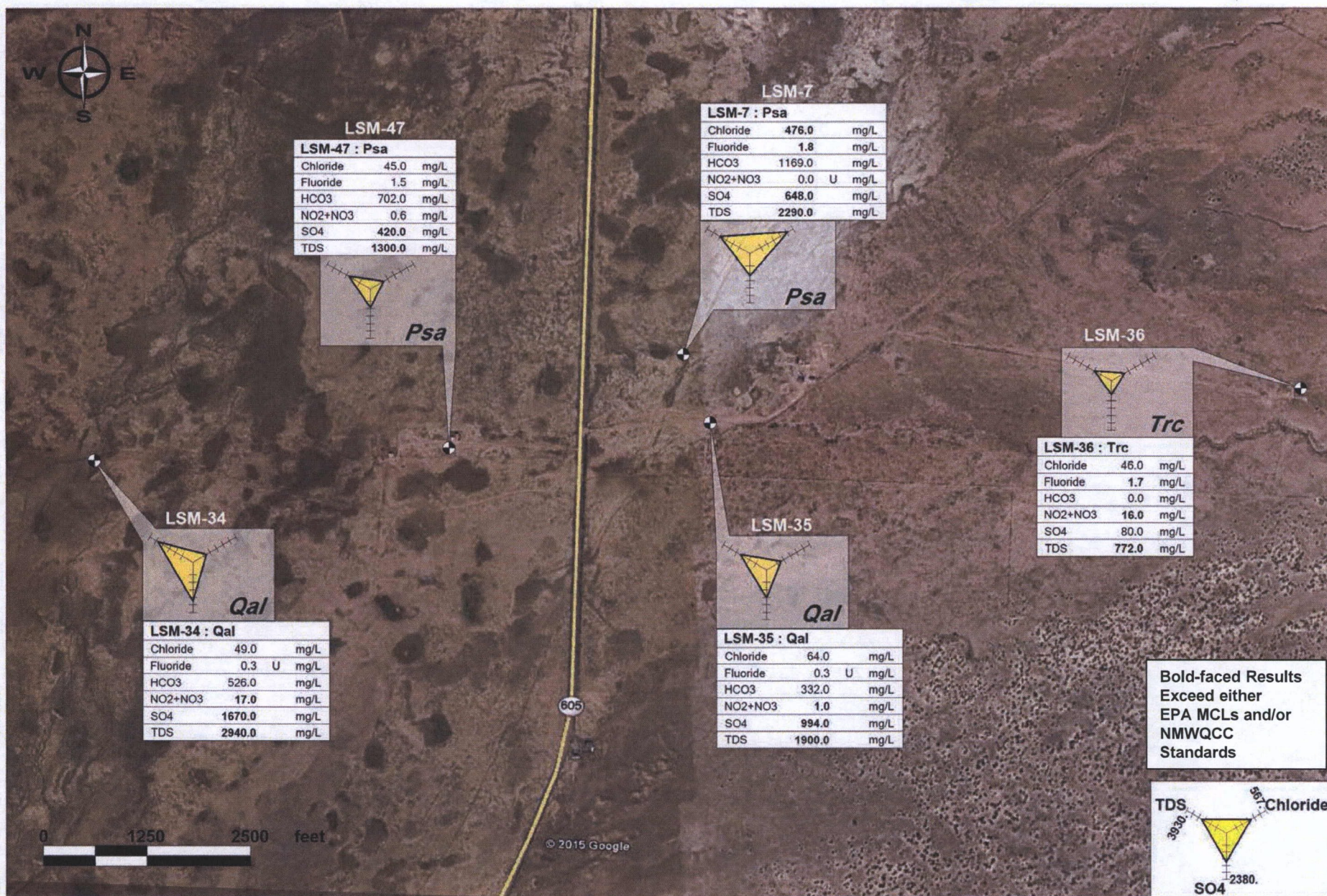


**Figure 6**  
**General Chemistry Results - Stiff Diagrams**  
 Alluvial & Morrison/Westwater Aquifer Wells - Upper Basin Area



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**Figure 7**

General Chemistry Results - Data Tables & Radial Diagrams  
Alluvial, Chinle, & San Andres Aquifer Wells - Middle Basin Area



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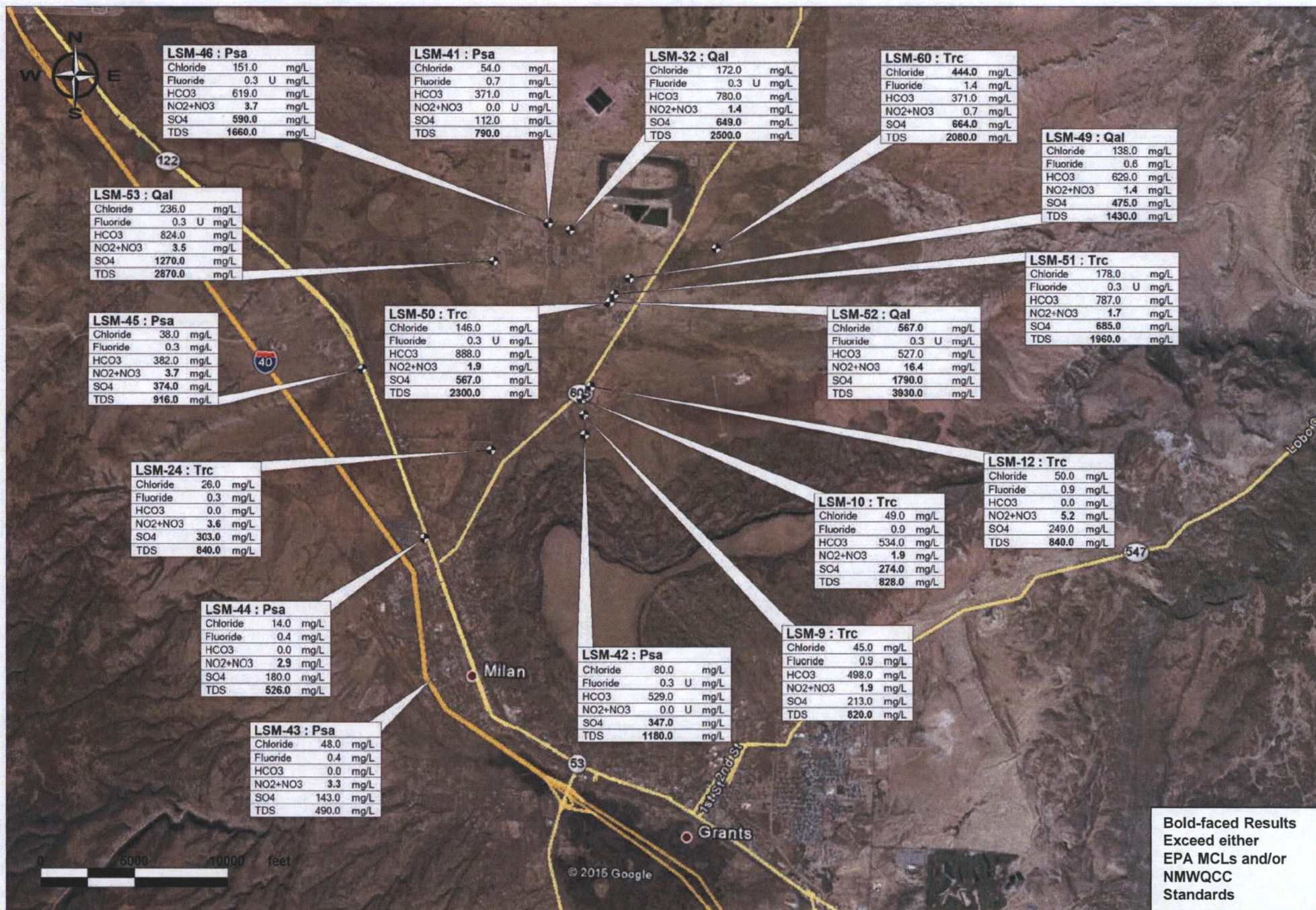
**Figure 8**

**General Chemistry Results - Stiff Diagrams**  
 Alluvial, Chinle, & San Andres Aquifer Wells - Middle Basin Area



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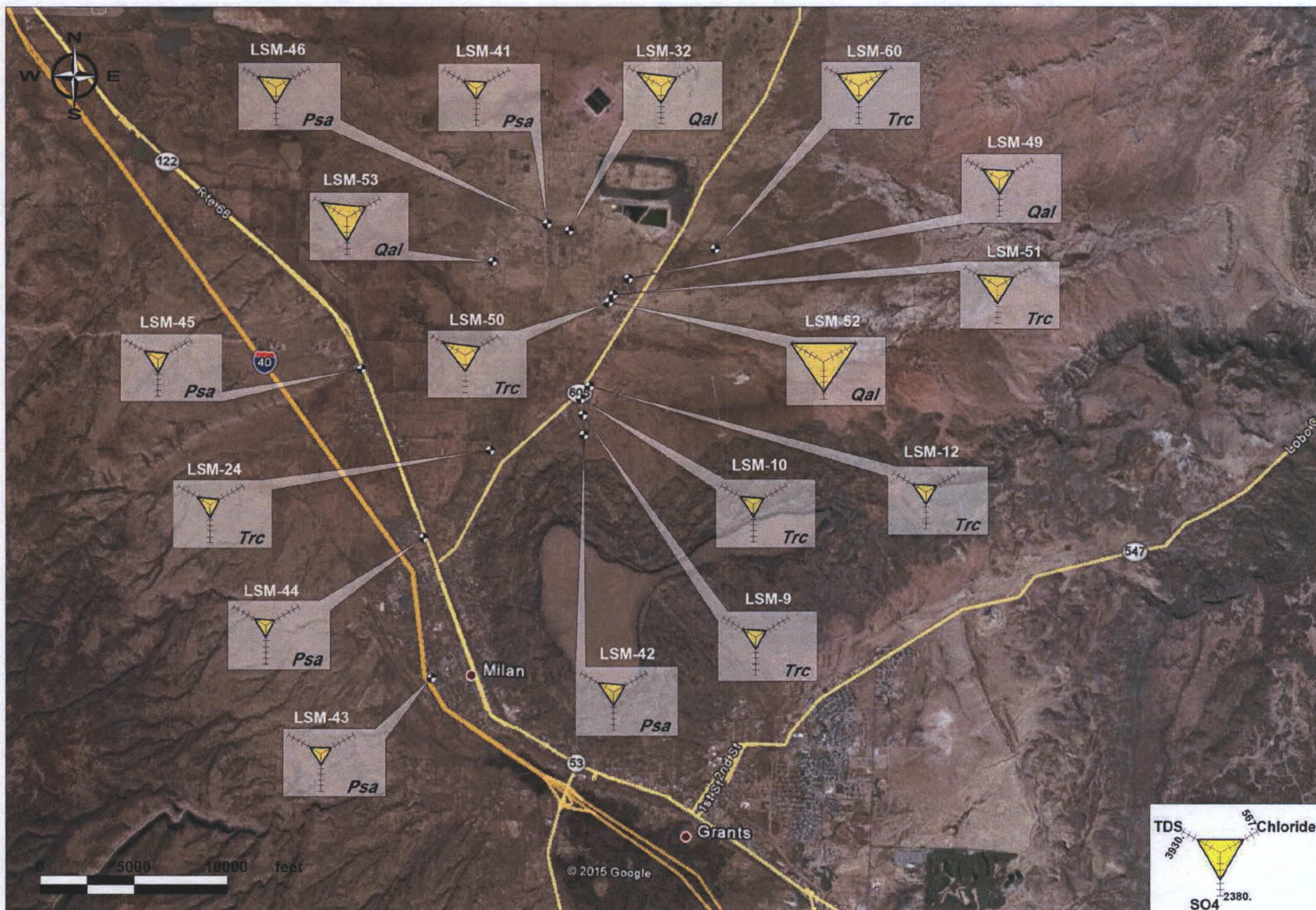
**Figure 9**  
General Chemistry Results - Data Tables

Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area



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**Figure 10**  
**General Chemistry Results - Radial Diagrams**  
 Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area



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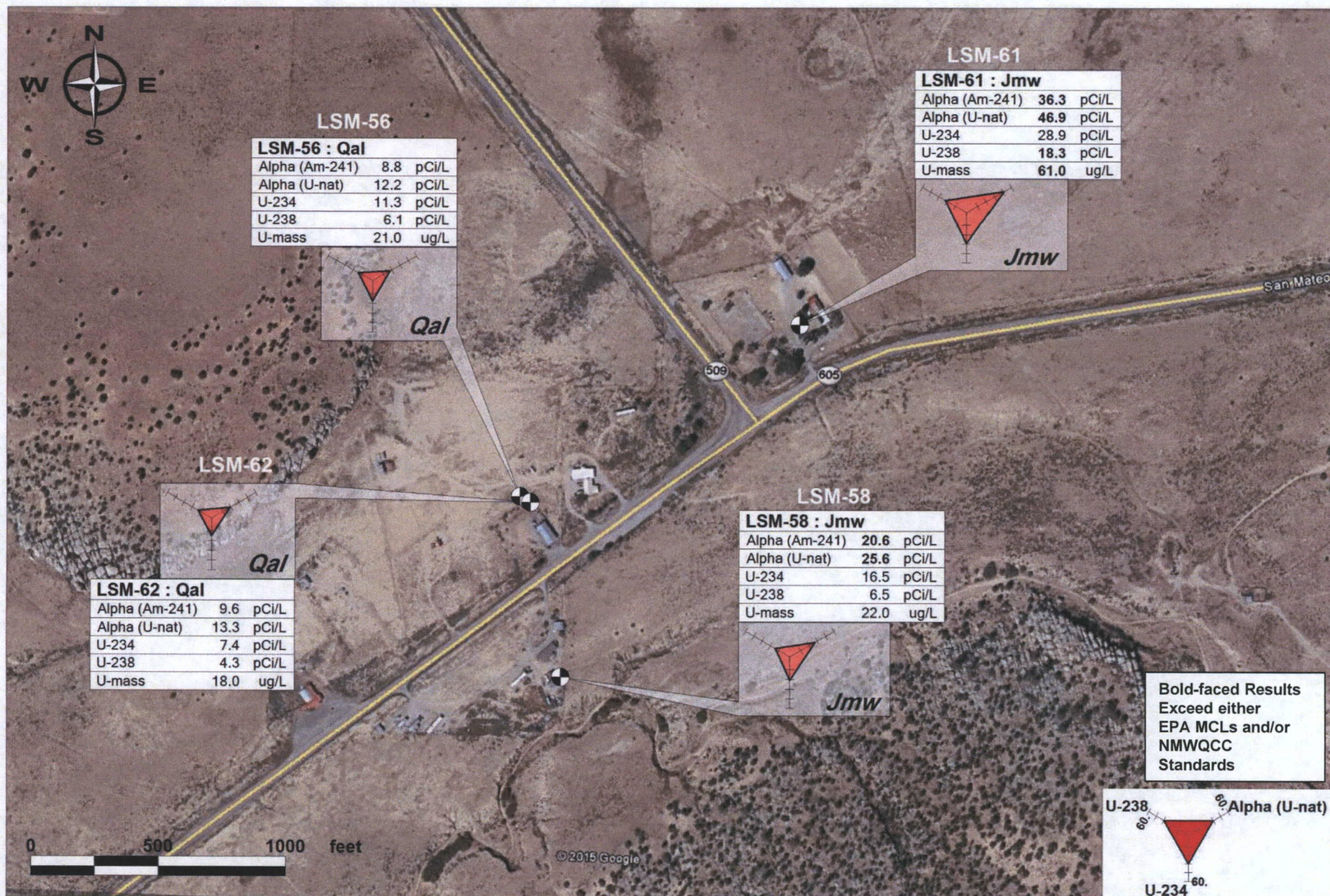


**Figure 11**  
**General Chemistry Results - Stiff Diagrams**  
 Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area



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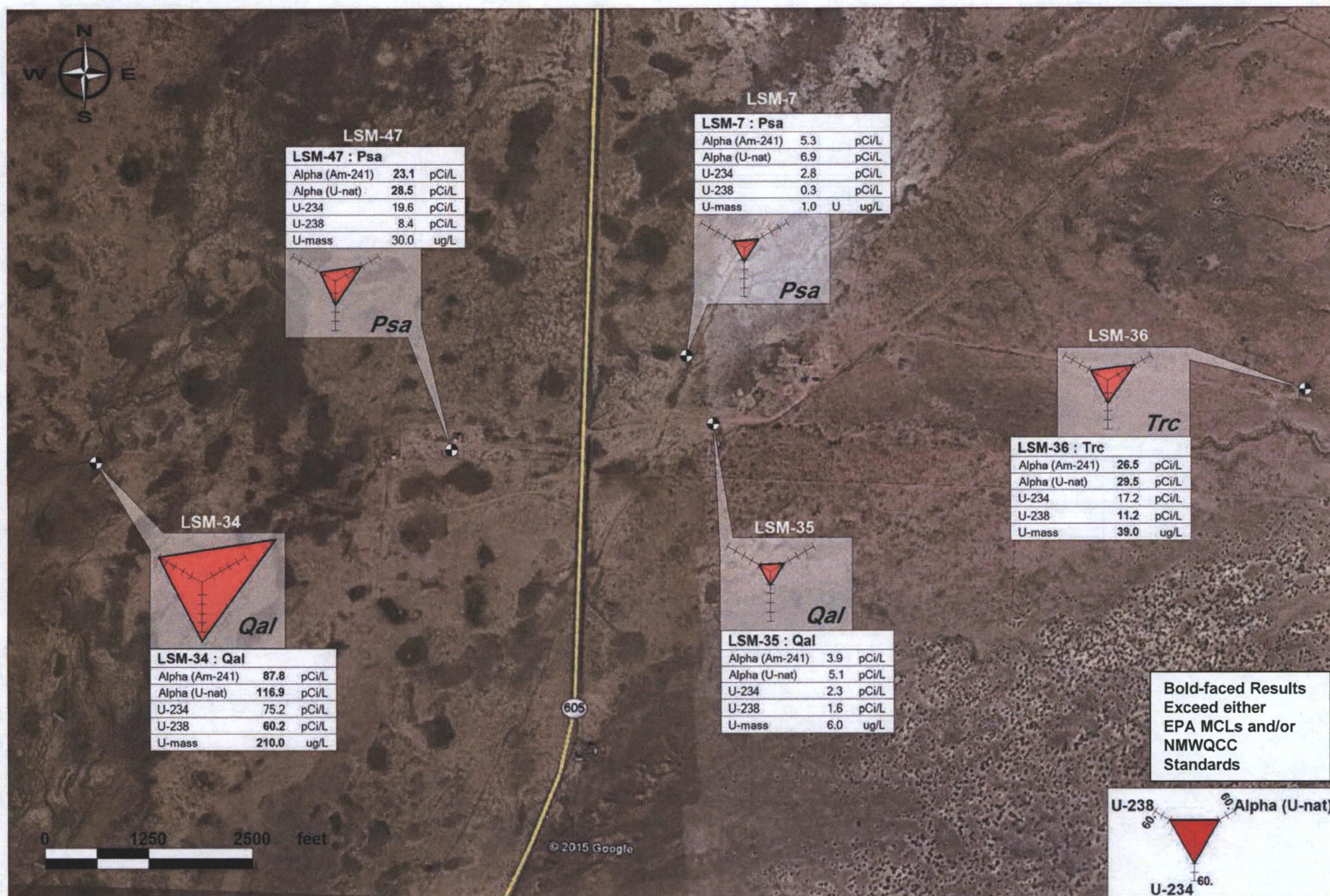
**Figure 12**

**Radiochemistry Results - Data Tables & Radial Diagrams**  
**Alluvial & Morrison/Westwater Aquifer Wells - Upper Basin Area**



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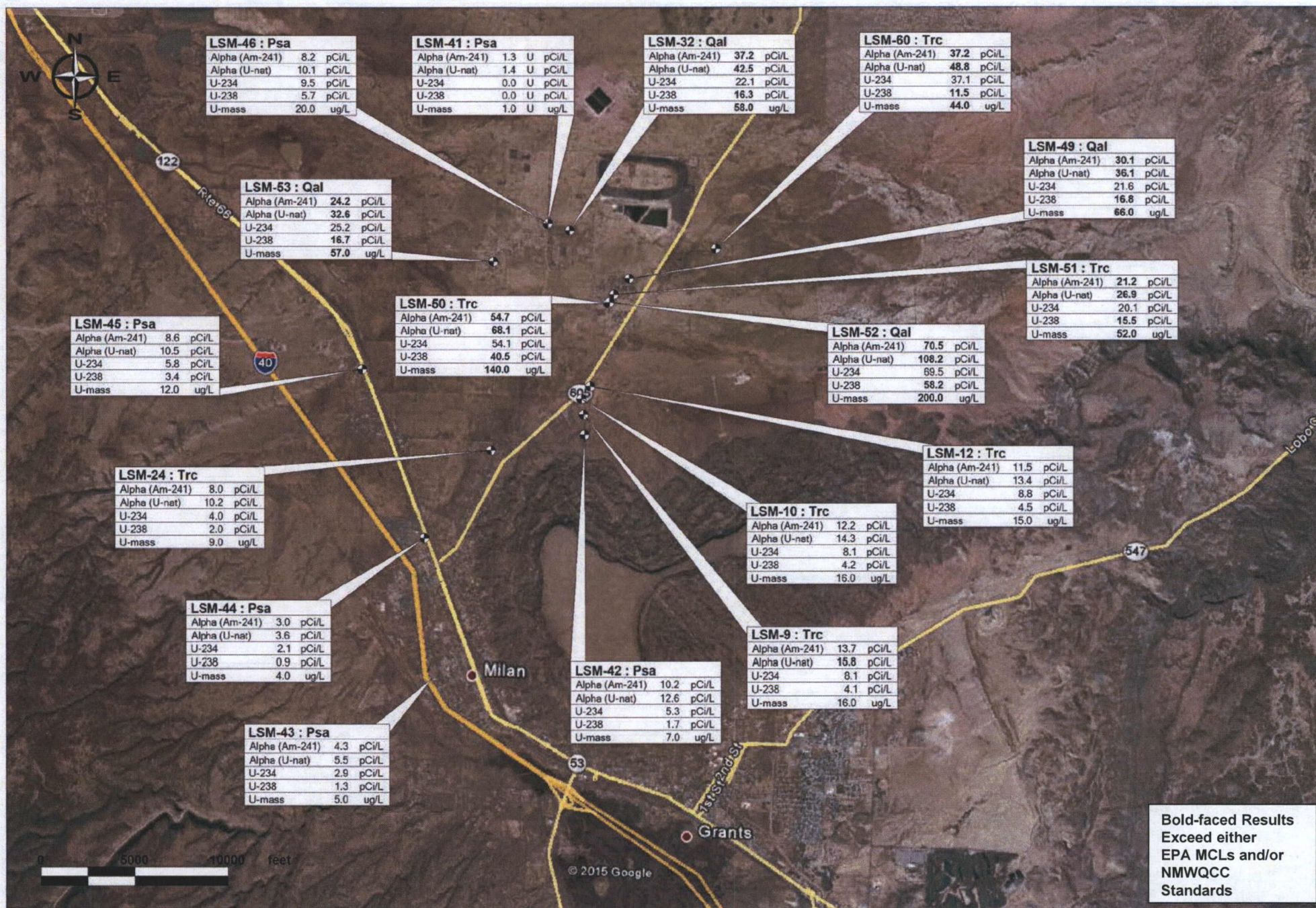
**Figure 13**

Radiochemistry Results - Data Tables & Radial Diagrams  
Alluvial, Chinle, & San Andres Aquifer Wells - Middle Basin Area



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**Figure 14**

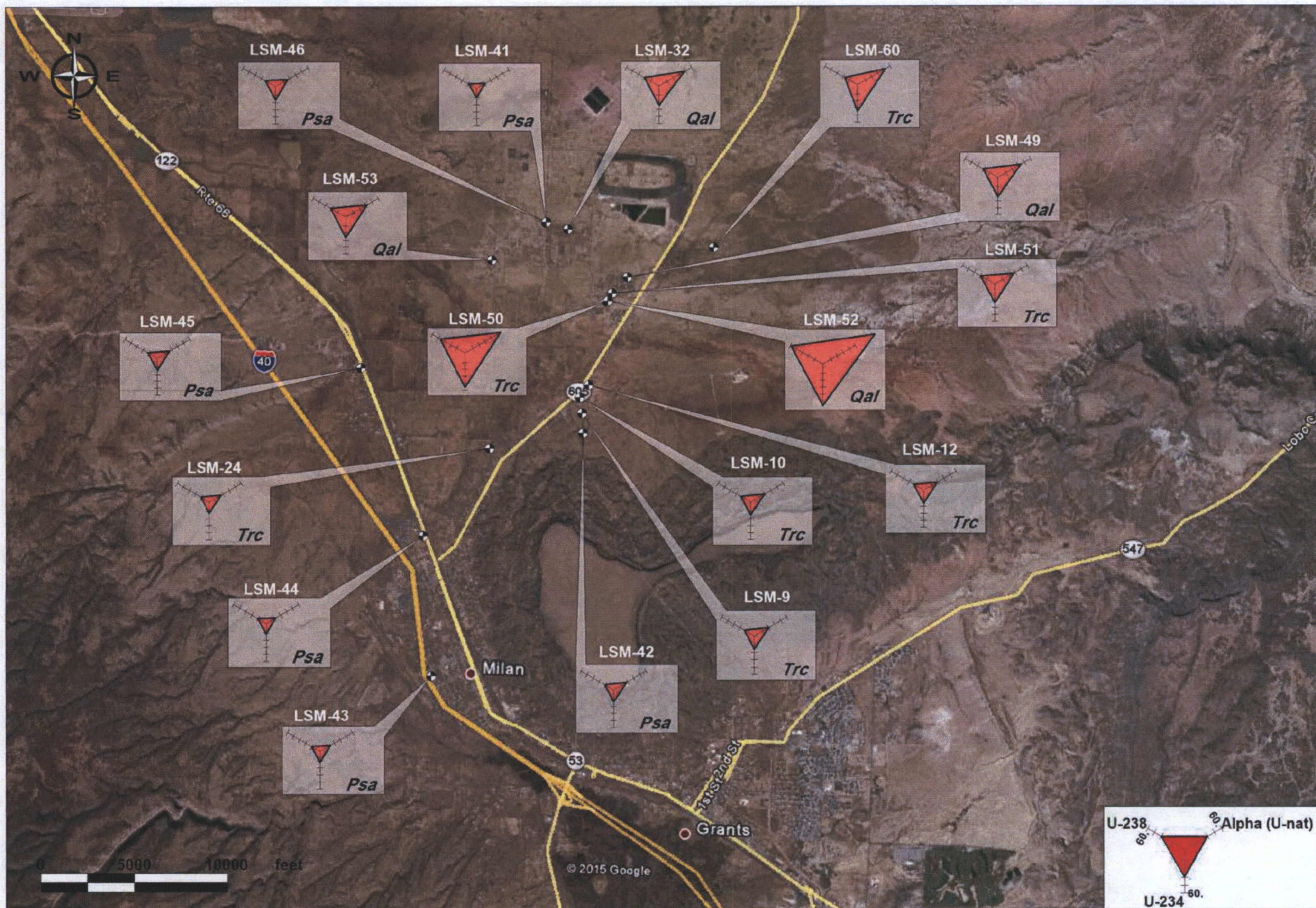
**Radiochemistry Results - Data Tables**

Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area



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**Figure 15**

**Radiochemistry Results - Radial Diagrams**

Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area



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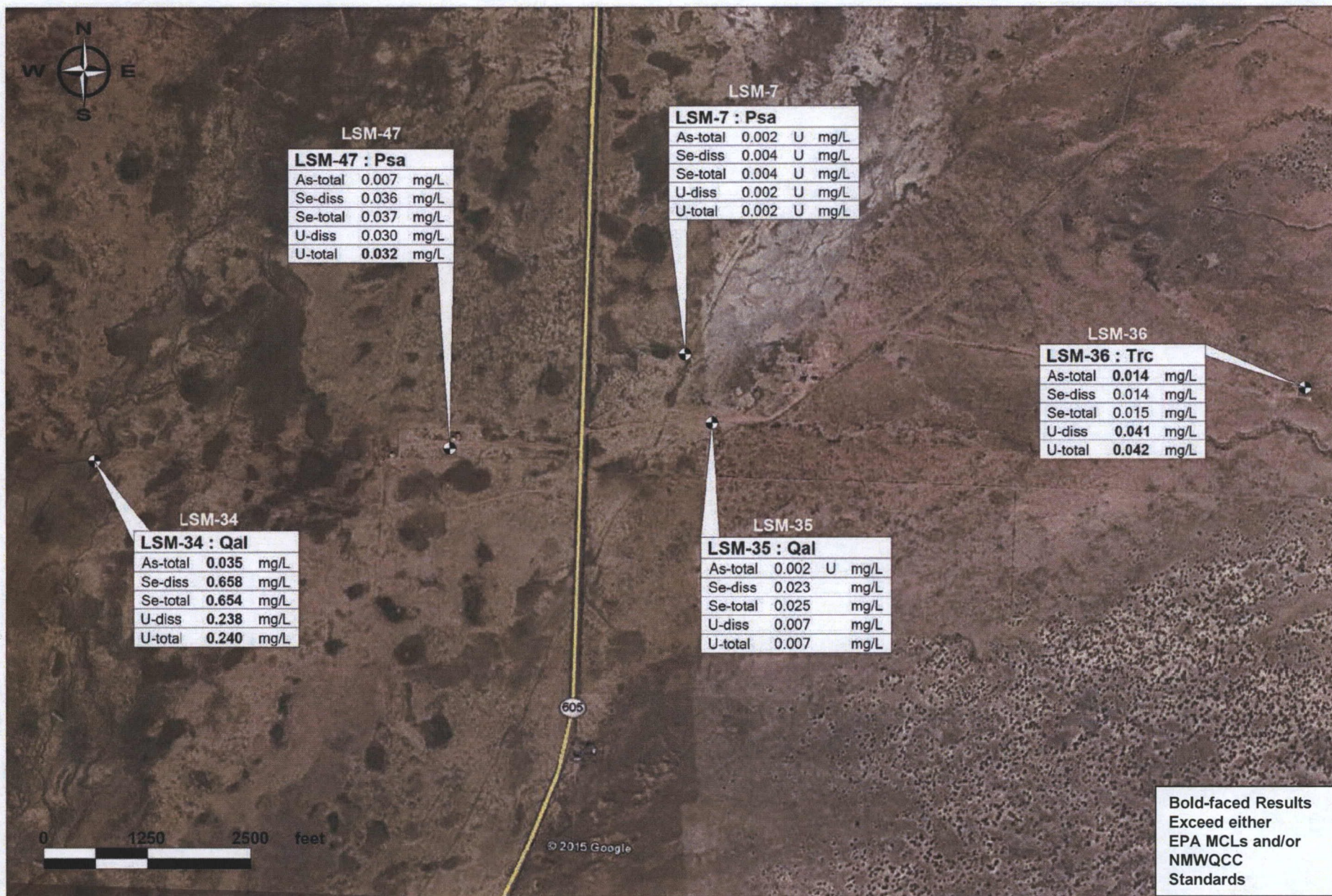
**Figure 16**

**Total Metals & Dissolved Metals Results - Data Tables**  
**Alluvial & Morrison/Westwater Aquifer Wells - Upper Basin Area**



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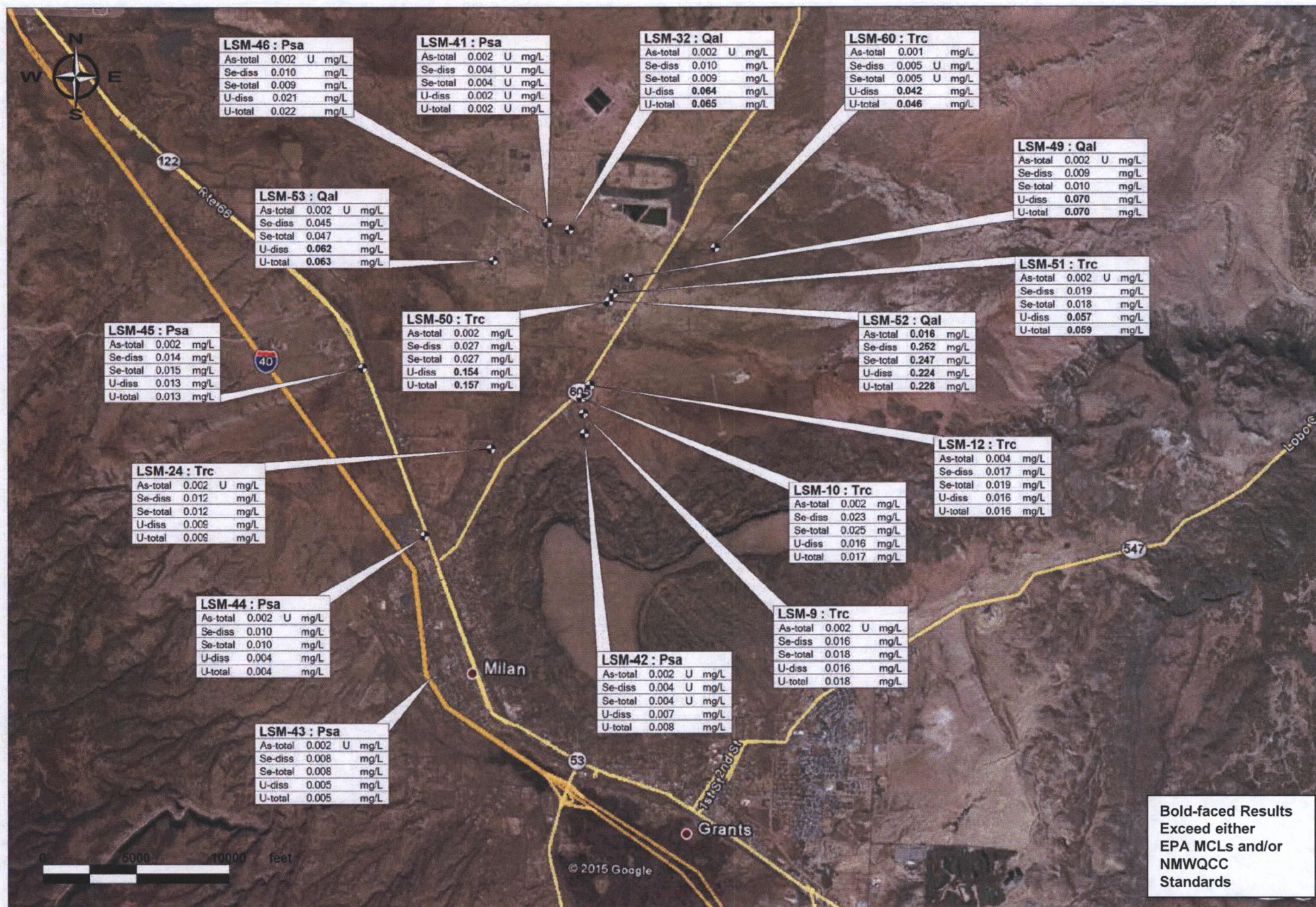


**Figure 17**  
**Total & Dissolved Metals Results - Data Tables**  
 Alluvial, Chinle, & San Andres Aquifer Wells - Middle Basin Area



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**Figure 18**

**Total & Dissolved Metals Results - Data Tables**  
**Alluvial, Chinle, & San Andres Aquifer Wells - Lower Basin Area**



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## Tables

**Table 1: Ground Water Well Usage within the San Mateo Creek Basin**

<u>GROUND WATER USAGE</u>		<u>TOTALS</u>
<b>Consumptive</b>		2,213
	Single domestic wells <sup>1</sup>	203
	Multiple domestic and community wells <sup>1</sup>	10
	Municipal water supply wells <sup>2</sup>	2000
<b>Irrigation, sanitary, industrial, and stock wells</b>		241
<b>Other well usages</b>	Including dewatering, exploration, mining, milling, oil, monitoring, no recorded use of right, observation, prospecting, construction, and no documented usage category	79

**Notes:**

<sup>1</sup> New Mexico Office of the State Engineer (OSE), 2011, New Mexico Water Rights Reporting System Database.

<sup>2</sup> New Mexico Drinking Water Bureau, Safe Drinking Water Information System (SDWIS) Database.

The Village of Milan Community Water System serves an estimated population of 2,000 people. There are three active water supply wells.

**Table 2: Laboratory Analyses for General Chemistry, Total and Dissolved Metals, and Radiochemistry**

<b>Laboratory Analyses</b>	<b>General Geochemistry</b>	<b>Metals (total-unfiltered &amp; dissolved-filtered) <sup>1</sup></b>	<b>Radionuclides (total-unfiltered) <sup>2</sup></b>
Analytical Methods	EPA 160.1, 310.1 EPA 300.0, 340.2 EPA 353.2	ISM01.3 ICP-MS; SW-846/6010B; 200.8	EPA 900 series; 903.1; 904; 907; 910; ASTM D5072-92 for Radon
Analytes	TDS, HCO <sub>3</sub> , CO <sub>3</sub> SO <sub>4</sub> , Cl, F NO <sub>3</sub> +NO <sub>2</sub> Ca, K, Mg, Na	Al, As, Cu, Fe, Pb, Mo, Mn, Se, U (includes Ca, Cl, K, Mg, Na)	Gross Alpha, Ra-226, Ra-228, Th-227, Th-228, Th-230, Th-232, U-234, U-235, U-238 Rn(gas)

**Notes:**

<sup>1</sup> U.S. Environmental Protection Agency, Risk and Site Assessment Section (6SF-TR), 2013. Draft Human Health Risk Assessment, Homestake Mining Co. Superfund Site, Milan, Cibola County, New Mexico (Ref. 21)

<sup>2</sup> New Mexico Environment Department, Ground Water Quality Bureau, Superfund Oversight Section, 2007. Summary report on 2005-2006 residential well sampling within the vicinity of the Homestake Mining Company Uranium Mill Superfund Site, CERCLIS # NMD007860935, Cibola County, New Mexico (Ref 11)

**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-7 10/8/2014	LSM-9 10/8/2014	LSM-10 10/7/2014	LSM-12 10/7/2014
<b>Dissolved Metals</b>							
Aluminum	mg/L	NA	0.1	0.5 U	0.3 U	0.2 U	0.2 U
Antimony	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.0027
Barium	mg/L	NA	1	0.05 U	0.03 U	0.02 U	0.0222
Beryllium	mg/L	NA	NP	0.025 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NA	NP	NA	NA	NA	NA
Cadmium	mg/L	NA	0.01	0.025 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NA	NP	12.3	8.45	9.11	9.88
Chromium	mg/L	NA	0.05	0.05 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NA	NP	0.1 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	NA	1	0.1 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NA	1	0.125 U	0.075 U	0.05 U	0.05 U
Lead	mg/L	NA	0.05	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NA	NP	1.18	2.45	2.61	2.16
Manganese	mg/L	NA	0.2	0.025 U	0.015 U	0.01 U	0.01 U
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.0464	0.0026	0.0023	0.0032
Nickel	mg/L	NA	NP	0.1 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NA	NP	5 U	4.19 J	5.52 J	4.71 J
Selenium	mg/L	NA	0.05	0.004 U	0.0164	0.023	0.017
Silver	mg/L	NA	0.05	0.05 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NA	NP	1050 J	307 J	351 J	362 J
Thallium	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NA	NP	NA	NA	NA	NA
Uranium	mg/L	NA	0.03	0.002 U	0.0163	0.0159	0.0161
Vanadium	mg/L	NA	NP	0.1 U	0.06 U	0.04 U	0.04 U
Zinc	mg/L	NA	10	0.1 U	0.06 U	0.04 U	0.0719
<b>General Chemistry</b>							
Estimated Alkalinity	mg/L	NP	NP	1169	498	534	253
Estimated Bicarbonate	mg/L	NP	NP	1169	498	534	NA
Calcium	mg/L	NP	NP	12.3	8.45	9.11	9.88
Carbonate	mg/L	NP	NP	NA	NA	NA	NA
Chloride	mg/L	NP	250	476	45	49	50
Fluoride	mg/L	NP	1.6	1.82	0.93	0.89	0.93
Iron	mg/L	NP	NP	0.125 U	0.075 U	0.05 U	0.05 U
Magnesium	mg/L	NP	NP	1.18	2.45	2.61	2.16
Manganese	mg/L	NP	NP	0.0273	0.015 U	0.01 U	0.01 U
Nitrate as N	mg/L	1	10	0.02	1.9	NA	5.17
Nitrate+Nitrite as N	mg/L	1	NP	0.04 U	1.89	1.94	5.16
Nitrite as N	mg/L	1	NP	0.0006 U	0.0006 U	NA	0.0006 U
pH	pH Units	6.5-8.5	6-9	8.1	7.9	8.06	8.08
Potassium	mg/L	NP	NP	5 U	4.19 J	5.52 J	4.71 J
Sodium	mg/L	NP	NP	1050 J	307 J	351 J	362 J
Sulfate	mg/L	250	600	648	213	274	249
Total Dissolved Solids	mg/L	500	1000	2290	820	828	840
Total Hardness	mg/L	NP	NP	NA	NA	NA	NA



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-7 10/8/2014	LSM-9 10/8/2014	LSM-10 10/7/2014	LSM-12 10/7/2014
<b>Total Metals</b>							
Aluminum	mg/L	NP	NA	0.5 U	0.3 U	0.2 U	0.2 U
Antimony	mg/L	0.006	NA	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	NA	0.002 U	0.002 U	0.0024	0.0035
Barium	mg/L	2	NA	0.05 U	0.03 U	0.0204	0.0209
Beryllium	mg/L	0.004	NA	0.025 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NP	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	NA	0.025 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NP	NA	11.5	8.47	9.38	9.21
Chromium	mg/L	0.1	NA	0.05 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NP	NA	0.1 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	1.3	NA	0.1 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NP	NA	0.125 U	0.0887	0.05 U	0.05 U
Lead	mg/L	0.015	NA	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NP	NA	1.08	2.49	2.68	1.99
Manganese	mg/L	NP	NA	0.0273	0.015 U	0.01 U	0.01 U
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.0443	0.0027	0.0024	0.003
Nickel	mg/L	NP	NA	0.1 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NP	NA	5 U	5.37 J	6.14 J	4.92 J
Selenium	mg/L	0.05	NA	0.004 U	0.0176	0.0248	0.0188
Silver	mg/L	NP	NA	0.05 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NP	NA	1130 J	349 J	366 J	371 J
Thallium	mg/L	0.002	NA	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NP	NA	NA	NA	NA	NA
Uranium	mg/L	0.03	NA	0.002 U	0.0177	0.0167	0.0162
Vanadium	mg/L	NP	NA	0.1 U	0.06 U	0.04 U	0.04 U
Zinc	mg/L	NP	NA	0.1 U	0.06 U	0.04 U	0.0583
<b>Radiological</b>							
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	5.3 (+/- 1)	13.7 (+/- 1.2)	12.2 (+/- 1.1)	11.5 (+/- 1.1)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	6.9 (+/- 1.3)	15.8 (+/- 1.4)	14.3 (+/- 1.3)	13.4 (+/- 1.3)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	2.9 U (+/- 1.5)	3.8 (+/- 1.2)	4.7 (+/- 1.2)	6.6 (+/- 1.3)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	2.9 U (+/- 1.5)	3.9 (+/- 1.3)	4.9 (+/- 1.3)	6.9 (+/- 1.3)
Ra226, SDWA Method	pCi/L	5	30	0.29 (+/- 0.02)	0.04 (+/- 0.01)	0.05 (+/- 0.01)	0.03 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.14 U (+/- 0.06)	0.14 U (+/- 0.08)	0.14 U (+/- 0.08)	0.19 (+/- 0.08)
Radon	pCi/L	NP	NP	1124 (+/- 211)	125.5 (+/- 43.6)	336.6 (+/- 74.4)	218.5 (+/- 54.8)
Radon 222	pCi/L	NP	NP	NA	NA	NA	NA
Radon 222 MDC	pCi/L	NP	NP	NA	NA	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	NA	NA	NA	NA
Thorium-228	pCi/L	NP	NP	-0.193 (+/- 0.173)	-0.139 (+/- 0.152)	-0.067 (+/- 0.057)	-0.034 (+/- 0.071)
Thorium-230	pCi/L	NP	NP	-0.051 (+/- 0.167)	-0.008 (+/- 0.148)	0.000 (+/- 0.043)	0.025 (+/- 0.039)
Thorium-232	pCi/L	NP	NP	-0.017 (+/- 0.167)	-0.03 (+/- 0.0148)	-0.019 (+/- 0.043)	0.00 (+/- 0.039)
U234, by Alpha Spec	pCi/L	NP	NP	2.8 (+/- 0.12)	8.1 (+/- 0.24)	8.1 (+/- 0.24)	8.8 (+/- 0.27)
U238, by Alpha Spec	pCi/L	10	NP	0.27 (+/- 0.03)	4.1 (+/- 0.13)	4.2 (+/- 0.14)	4.5 (+/- 0.16)
Uranium, Mass Concentration	ug/L	30	NP	1 U (+/- 0.5)	16 (+/- 1.6)	16 (+/- 1.6)	15 (+/- 1.5)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for Nitrite.

Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for Nitrite.

Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency (EPA) for drinking water quality.

An MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act.

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable to

groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants, these standards apply to dissolved metals.

NWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-24 10/7/2014	LSM-32 10/9/2014	LSM-34 10/7/2014	LSM-35 10/7/2014	LSM-36 10/6/2014
<b>Dissolved Metals</b>								
Aluminum	mg/L	NA	0.1	0.1 U	0.2 U	0.3 U	0.2 U	0.2 U
Antimony	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	NA	NP	0.002 U	0.002 U	0.0342	0.002 U	0.0148
Barium	mg/L	NA	1	0.0309	0.02 U	0.03 U	0.02 U	0.0265
Beryllium	mg/L	NA	NP	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NA	NP	NA	NA	NA	NA	NA
Cadmium	mg/L	NA	0.01	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NA	NP	131	226 J	362	143	1.53
Chromium	mg/L	NA	0.05	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	NA	1	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NA	1	0.0422	0.267	0.075 U	0.896	0.05 U
Lead	mg/L	NA	0.05	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NA	NP	36.3	55.5	70.1	30.5	0.3 U
Manganese	mg/L	NA	0.2	0.0519	0.0133	0.015 U	0.0691	0.01 U
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.002 U	0.002 U	0.0036	0.002 U	0.0164
Nickel	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NA	NP	7.26 J	7.94 J	14.8 J	4.68 J	2 U
Selenium	mg/L	NA	0.05	0.012	0.0099	0.658	0.0229	0.0142
Silver	mg/L	NA	0.05	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NA	NP	88.8 J	353 J	483 J	421 J	307 J
Thallium	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NA	NP	NA	NA	NA	NA	NA
Uranium	mg/L	NA	0.03	0.0091	0.0642	0.238	0.0065	0.0411
Vanadium	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.308
Zinc	mg/L	NA	10	0.02 U	0.217	0.06 U	0.04 U	0.04 U
<b>General Chemistry</b>								
Estimated Alkalinity	mg/L	NP	NP	260	780	526	332	280
Estimated Bicarbonate	mg/L	NP	NP	NA	780	526	332	NA
Calcium	mg/L	NP	NP	131	226 J	362	143	1.53
Carbonate	mg/L	NP	NP	NA	NA	NA	NA	NA
Chloride	mg/L	NP	250	26	172	49	64	46
Fluoride	mg/L	NP	1.6	0.34	0.25 U	0.25 U	0.25 U	1.72
Iron	mg/L	NP	NP	0.0422	0.267	0.075 U	0.896	0.05 U
Magnesium	mg/L	NP	NP	36.3	55.5	70.1	30.5	0.3 U
Manganese	mg/L	NP	NP	0.0567	0.012	0.0152	0.104	0.01 U
Nitrate as N	mg/L	1	10	3.6	1.43	17	NA	16
Nitrate+Nitrite as N	mg/L	1	NP	3.62	1.43	17	1.04	16
Nitrite as N	mg/L	1	NP	0.0006 U	0.0006 U	0.0006 U TQ03	NA	0.0006 U
pH	pH Units	6.5-8.5	6-9	7.43	7.19	7.27	7.64	8.73
Potassium	mg/L	NP	NP	7.26 J	7.94 J	14.8 J	4.68 J	2 U
Sodium	mg/L	NP	NP	88.8 J	353 J	483 J	421 J	307 J
Sulfate	mg/L	250	600	303	649	1670	994	80
Total Dissolved Solids	mg/L	500	1000	840	2500	2940	1900	772
Total Hardness	mg/L	NP	NP	NA	NA	NA	NA	NA

**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-24 10/7/2014	LSM-32 10/9/2014	LSM-34 10/7/2014	LSM-35 10/7/2014	LSM-36 10/6/2014
<b>Total Metals</b>								
Aluminum	mg/L	NP	NA	0.1 U	0.2 U	0.3 U	0.571	0.2 U
Antimony	mg/L	0.006	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	NA	0.002 U	0.002 U	0.0349	0.002 U	0.0137
Barium	mg/L	2	NA	0.0314	0.02 U	0.03 U	0.0203	0.0272
Beryllium	mg/L	0.004	NA	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NP	NA	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	NA	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NP	NA	128	223	362	153	1.57
Chromium	mg/L	0.1	NA	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	1.3	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NP	NA	0.708	0.424	0.075 U	8.18	0.05 U
Lead	mg/L	0.015	NA	0.002 U	0.002 U	0.002 U	0.0021	0.002 U
Magnesium	mg/L	NP	NA	35.9	56.3	69.6	32.3	0.3 U
Manganese	mg/L	NP	NA	0.0567	0.012	0.0152	0.104	0.01 U
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.002 U	0.002 U	0.0035	0.002 U	0.0165
Nickel	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NP	NA	7.44 J	9.25 J	16.5 J	5.55 J	2.09 J
Selenium	mg/L	0.05	NA	0.0115	0.0091	0.654	0.0249	0.0149
Silver	mg/L	NP	NA	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NP	NA	89.6 J	380 J	524 J	466 J	314 J
Thallium	mg/L	0.002	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NP	NA	NA	NA	NA	NA	NA
Uranium	mg/L	0.03	NA	0.0088	0.0652	0.24	0.0066	0.0424
Vanadium	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.306
Zinc	mg/L	NP	NA	0.02 U	0.224	0.06 U	0.04 U	0.04 U
<b>Radiological</b>								
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	8 (+/- 1.1)	37.2 (+/- 2.9)	87.8 (+/- 5)	3.9 (+/- 0.8)	26.5 (+/- 1.9)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	10.2 (+/- 1.4)	42.5 (+/- 3.3)	116.9 (+/- 6.6)	5.1 (+/- 1)	29.5 (+/- 2.1)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	4.5 (+/- 1.1)	12.5 (+/- 3.1)	87.8 (+/- 5.2)	4.6 (+/- 1.2)	6.9 (+/- 1.7)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	4.5 (+/- 1.1)	13 (+/- 3.2)	88.9 (+/- 5.2)	4.5 (+/- 1.2)	7.2 (+/- 1.8)
Ra226, SDWA Method	pCi/L	5	30	0.11 (+/- 0.01)	0.12 (+/- 0.01)	0.2 (+/- 0.02)	0.07 (+/- 0.02)	0.04 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.14 U (+/- 0.06)	0.2 (+/- 0.08)	0.19 (+/- 0.08)	0.26 U (+/- 0.15)	0.14 U (+/- 0.07)
Radon	pCi/L	NP	NP	804 (+/- 154)	NA	830 (+/- 161)	321.9 (+/- 71.6)	436.5 (+/- 89.8)
Radon 222	pCi/L	NP	NP	NA	691	NA	NA	NA
Radon 222 MDC	pCi/L	NP	NP	NA	103	NA	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	NA	68.8	NA	NA	NA
Thorium-228	pCi/L	NP	NP	-0.051 (+/- 0.166)	-0.021 (+/- 0.188)	-0.097 (+/- 0.158)	-0.018 (+/- 0.118)	-0.104 (+/- 0.122)
Thorium-230	pCi/L	NP	NP	-0.02 (+/- 0.047)	-0.045 (+/- 0.173)	0.064 (+/- 0.154)	0.018 (+/- 0.049)	0.009 (+/- 0.061)
Thorium-232	pCi/L	NP	NP	0.02 (+/- 0.047)	-0.045 (+/- 0.173)	-0.008 (+/- 0.154)	0.071 (+/- 0.070)	0.028 (+/- 0.043)
U234, by Alpha Spec	pCi/L	NP	NP	4 (+/- 0.12)	22.1 (+/- 0.63)	75.2 (+/- 2.06)	2.3 (+/- 0.12)	17.2 (+/- 0.47)
U238, by Alpha Spec	pCi/L	10	NP	2 (+/- 0.07)	16.3 (+/- 0.48)	60.2 (+/- 1.72)	1.6 (+/- 0.1)	11.2 (+/- 0.32)
Uranium, Mass Concentration	ug/L	30	NP	9 (+/- 0.9)	58 (+/- 5.8)	210 (+/- 21)	6 (+/- 0.6)	39 (+/- 3.9)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency

An MCL is the legal threshold limit on the amount of a substance that is allowed in public

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable

groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants

NMWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-41 10/9/2014	LSM-42 10/8/2014	LSM-43 10/6/2014	LSM-44 10/6/2014	LSM-45 10/6/2014
<b>Dissolved Metals</b>								
Aluminum	mg/L	NA	0.1	0.2 U	0.2 U	0.1 U	0.1 U	0.1 U
Antimony	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Barium	mg/L	NA	1	0.02 U	0.02 U	0.0314	0.0237	0.0365
Beryllium	mg/L	NA	NP	0.01 U	0.01 U	0.005 U	0.005 U	0.005 U
Boron	mg/L	NA	NP	NA	NA	NA	NA	NA
Cadmium	mg/L	NA	0.01	0.01 U	0.01 U	0.005 U	0.005 U	0.005 U
Calcium	mg/L	NA	NP	6.24	113	76.9	81.8	140
Chromium	mg/L	NA	0.05	0.02 U	0.02 U	0.01 U	0.01 U	0.01 U
Cobalt	mg/L	NA	NP	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Copper	mg/L	NA	1	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Iron	mg/L	NA	1	0.05 U	0.362	0.025 U	0.025 U	0.025 U
Lead	mg/L	NA	0.05	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NA	NP	4.56	39.7	30.3	27.4	40.2
Manganese	mg/L	NA	0.2	0.01 U	0.0737	0.005 U	0.005 U	0.005 U
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.0145	0.002 U	0.0033	0.0022	0.002 U
Nickel	mg/L	NA	NP	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Potassium	mg/L	NA	NP	5.45 J	9.45 J	3.74 J	4.05 J	7.25 J
Selenium	mg/L	NA	0.05	0.004 U	0.004 U	0.0081	0.0099	0.014
Silver	mg/L	NA	0.05	0.02 U	0.02 U	0.01 U	0.01 U	0.01 U
Sodium	mg/L	NA	NP	213 J	211 J	44.9 J	50.8 J	111 J
Thallium	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NA	NP	NA	NA	NA	NA	NA
Uranium	mg/L	NA	0.03	0.002 U	0.0071	0.0049	0.0038	0.0127
Vanadium	mg/L	NA	NP	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Zinc	mg/L	NA	10	0.04 U	0.0693	0.02 U	0.02 U	0.02 U
<b>General Chemistry</b>								
Estimated Alkalinity	mg/L	NP	NP	371	529	212	208	382
Estimated Bicarbonate	mg/L	NP	NP	371	529	NA	NA	382
Calcium	mg/L	NP	NP	6.24	113	76.9	81.8	140
Carbonate	mg/L	NP	NP	NA	NA	NA	NA	NA
Chloride	mg/L	NP	250	54	80	48	14	38
Fluoride	mg/L	NP	1.6	0.73	0.25 U	0.37	0.35	0.3
Iron	mg/L	NP	NP	0.05 U	0.362	0.025 U	0.025 U	0.025 U
Magnesium	mg/L	NP	NP	4.56	39.7	30.3	27.4	40.2
Manganese	mg/L	NP	NP	0.01 U	0.0799	0.005 U	0.005 U	0.005 U
Nitrate as N	mg/L	1	10	0 U	0 U	3.32	2.87	NA
Nitrate+Nitrite as N	mg/L	1	NP	0.04 U	0.04 U	3.31	2.86	3.72
Nitrite as N	mg/L	1	NP	0.0006 U	0.0006 U TQ02	0.0006 U	0.0006 U	NA
pH	pH Units	6.5-8.5	6-9	8.6	7.01	7.27	7.31	7.37
Potassium	mg/L	NP	NP	5.45 J	9.45 J	3.74 J	4.05 J	7.25 J
Sodium	mg/L	NP	NP	213 J	211 J	44.9 J	50.8 J	111 J
Sulfate	mg/L	250	600	112	347	143	180	374
Total Dissolved Solids	mg/L	500	1000	790	1180	490	526	916
Total Hardness	mg/L	NP	NP	NA	NA	NA	NA	NA

**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-41 10/9/2014	LSM-42 10/8/2014	LSM-43 10/6/2014	LSM-44 10/6/2014	LSM-45 10/6/2014
<b>Total Metals</b>								
Aluminum	mg/L	NP	NA	0.2 U	0.2 U	0.1 U	0.1 U	0.1 U
Antimony	mg/L	0.006	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.0021
Barium	mg/L	2	NA	0.02 U	0.02 U	0.0312	0.0262	0.037
Beryllium	mg/L	0.004	NA	0.01 U	0.01 U	0.005 U	0.005 U	0.005 U
Boron	mg/L	NP	NA	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	NA	0.01 U	0.01 U	0.005 U	0.005 U	0.005 U
Calcium	mg/L	NP	NA	6.06	123	77.9	85.6	147
Chromium	mg/L	0.1	NA	0.02 U	0.02 U	0.01 U	0.01 U	0.01 U
Cobalt	mg/L	NP	NA	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Copper	mg/L	1.3	NA	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Iron	mg/L	NP	NA	0.172	0.421	0.025 U	0.025 U	0.025 U
Lead	mg/L	0.015	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NP	NA	4.49	43.7	30.1	28.8	41.6
Manganese	mg/L	NP	NA	0.01 U	0.0799	0.005 U	0.005 U	0.005 U
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.0129	0.002	0.0033	0.0022	0.002 U
Nickel	mg/L	NP	NA	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Potassium	mg/L	NP	NA	5.96 J	11.7 J	3.95 J	4.62 J	7.94 J
Selenium	mg/L	0.05	NA	0.004 U	0.004 U	0.0082	0.0099	0.0153
Silver	mg/L	NP	NA	0.02 U	0.02 U	0.01 U	0.01 U	0.01 U
Sodium	mg/L	NP	NA	226 J	248 J	45.3 J	55.5 J	119 J
Thallium	mg/L	0.002	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NP	NA	NA	NA	NA	NA	NA
Uranium	mg/L	0.03	NA	0.002 U	0.0078	0.005	0.004	0.0129
Vanadium	mg/L	NP	NA	0.04 U	0.04 U	0.02 U	0.02 U	0.02 U
Zinc	mg/L	NP	NA	0.04 U	0.0718	0.02 U	0.02 U	0.02 U
<b>Radiological</b>								
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	1.3 U (+/- 0.6)	10.2 (+/- 1.1)	4.3 (+/- 0.9)	3 (+/- 0.6)	8.6 (+/- 1)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	1.4 U (+/- 0.7)	12.6 (+/- 1.4)	5.5 (+/- 1.1)	3.6 (+/- 0.8)	10.5 (+/- 1.2)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	2.6 (+/- 1)	12.8 (+/- 1.4)	3.9 (+/- 1)	4.7 (+/- 0.9)	7.2 (+/- 1.2)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	2.8 (+/- 1.1)	13 (+/- 1.4)	4 (+/- 1)	4.8 (+/- 0.9)	7.4 (+/- 1.2)
Ra226, SDWA Method	pCi/L	5	30	0.11 (+/- 0.01)	2.4 (+/- 0.08)	0.08 (+/- 0.01)	0.08 (+/- 0.01)	0.18 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.14 U (+/- 0.06)	3.1 (+/- 0.33)	0.14 U (+/- 0.08)	0.15 U (+/- 0.08)	0.14 U (+/- 0.08)
Radon	pCi/L	NP	NP	NA	NA	462.2 (+/- 94.4)	814 (+/- 156)	1113 (+/- 211)
Radon 222	pCi/L	NP	NP	65.7	746	NA	NA	NA
Radon 222 MDC	pCi/L	NP	NP	103	101	NA	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	60.3	68.2	NA	NA	NA
Thorium-228	pCi/L	NP	NP	-0.025 (+/- 0.211)	0.145 (+/- 0.218)	0.00 (+/- 0.078)	-0.051 (+/- 0.089)	-0.069 (+/- 0.093)
Thorium-230	pCi/L	NP	NP	0.000 (+/- 0.169)	-0.008 (+/- 0.165)	0.018 (+/- 0.089)	-0.042 (+/- 0.055)	-0.029 (+/- 0.045)
Thorium-232	pCi/L	NP	NP	-0.026 (+/- 0.169)	0.03 (+/- 0.165)	-0.028 (+/- 0.048)	-0.034 (+/- 0.053)	0.029 (+/- 0.045)
U234, by Alpha Spec	pCi/L	NP	NP	0.03 U (+/- 0.01)	5.3 (+/- 0.17)	2.9 (+/- 0.09)	2.1 (+/- 0.07)	5.8 (+/- 0.16)
U238, by Alpha Spec	pCi/L	10	NP	0.02 U (+/- 0.01)	1.7 (+/- 0.08)	1.3 (+/- 0.05)	0.92 (+/- 0.04)	3.4 (+/- 0.1)
Uranium, Mass Concentration	ug/L	30	NP	1 U (+/- 0.5)	7 (+/- 0.7)	5 (+/- 0.5)	4 (+/- 0.5)	12 (+/- 1.2)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency.

An MCL is the legal threshold limit on the amount of a substance that is allowed in public

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable

groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants

NMWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-80FD 10/6/2014	LSM-46 10/8/2014	LSM-47 10/7/2014	LSM-49 10/7/2014	LSM-85FD 10/7/2014
<b>Dissolved Metals</b>								
Aluminum	mg/L	NA	0.1	0.1 U	0.2 U	0.3 U	0.2 U	0.2 U
Antimony	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	NA	NP	0.002 U	0.002 U	0.0077	0.002 U	0.002 U
Barium	mg/L	NA	1	0.0359	0.02 U	0.03 U	0.02 U	0.02 U
Beryllium	mg/L	NA	NP	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NA	NP	NA	NA	NA	NA	NA
Cadmium	mg/L	NA	0.01	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NA	NP	141	192	3.06	140	141
Chromium	mg/L	NA	0.05	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	NA	1	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NA	1	0.025 U	0.05 U	0.075 U	0.05 U	0.05 U
Lead	mg/L	NA	0.05	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NA	NP	40.2	63.2	0.45 U	42.3	42.7
Manganese	mg/L	NA	0.2	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.002 U	0.002 U	0.0095	0.002 U	0.002 U
Nickel	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NA	NP	7.08 J	17.7 J	3 U	11.1 J	11.2 J
Selenium	mg/L	NA	0.05	0.0139	0.0095	0.0359	0.009	0.0091
Silver	mg/L	NA	0.05	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NA	NP	110 J	269 J	497 J	312 J	313 J
Thallium	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NA	NP	NA	NA	NA	NA	NA
Uranium	mg/L	NA	0.03	0.0126	0.0214	0.0298	0.0695	0.0691
Vanadium	mg/L	NA	NP	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Zinc	mg/L	NA	10	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
<b>General Chemistry</b>								
Estimated Alkalinity	mg/L	NP	NP	385	619	702	629	634
Estimated Bicarbonate	mg/L	NP	NP	385	619	702	629	634
Calcium	mg/L	NP	NP	141	192	3.06	140	141
Carbonate	mg/L	NP	NP	NA	NA	NA	NA	NA
Chloride	mg/L	NP	250	38	151	45	138	138
Fluoride	mg/L	NP	1.6	0.26	0.25 U	1.49	0.56	0.25 U
Iron	mg/L	NP	NP	0.025 U	0.05 U	0.075 U	0.05 U	0.05 U
Magnesium	mg/L	NP	NP	40.2	63.2	0.45 U	42.3	42.7
Manganese	mg/L	NP	NP	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Nitrate as N	mg/L	1	10	NA	3.74	NA	1.43	1.48
Nitrate+Nitrite as N	mg/L	1	NP	3.69	3.74	0.58	1.42	1.47
Nitrite as N	mg/L	1	NP	NA	0.0006 U TQ02	NA	0.0006 U TQ03	0.0006 U
pH	pH Units	6.5-8.5	6-9	7.74	7.02	8.64	7.19	7.17
Potassium	mg/L	NP	NP	7.08 J	17.7 J	3 U	11.1 J	11.2 J
Sodium	mg/L	NP	NP	110 J	269 J	497 J	312 J	313 J
Sulfate	mg/L	250	600	372	590	420	475	478
Total Dissolved Solids	mg/L	500	1000	1110	1660	1300	1430	1430
Total Hardness	mg/L	NP	NP	NA	NA	NA	NA	NA

**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-80FD 10/6/2014	LSM-46 10/8/2014	LSM-47 10/7/2014	LSM-49 10/7/2014	LSM-85FD 10/7/2014
<b>Total Metals</b>								
Aluminum	mg/L	NP	NA	0.1 U	0.2 U	0.3 U	0.2 U	0.2 U
Antimony	mg/L	0.006	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	NA	0.002 U	0.002 U	0.0067	0.002 U	0.002 U
Barium	mg/L	2	NA	0.0358	0.02 U	0.03 U	0.02 U	0.02 U
Beryllium	mg/L	0.004	NA	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Boron	mg/L	NP	NA	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	NA	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Calcium	mg/L	NP	NA	140	199	3.17	138	138
Chromium	mg/L	0.1	NA	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Cobalt	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Copper	mg/L	1.3	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Iron	mg/L	NP	NA	0.025 U	0.0511	0.075 U	0.0717	0.0703
Lead	mg/L	0.015	NA	0.002 U	0.0021	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NP	NA	39.7	66.8	0.45 U	42.2	42
Manganese	mg/L	NP	NA	0.005 U	0.01 U	0.015 U	0.01 U	0.01 U
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.002 U	0.002 U	0.01	0.002 U	0.002 U
Nickel	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Potassium	mg/L	NP	NA	7.35 J	21.1 J	3 U	12.6 J	12.9 J
Selenium	mg/L	0.05	NA	0.0134	0.0088	0.0374	0.0098	0.0102
Silver	mg/L	NP	NA	0.01 U	0.02 U	0.03 U	0.02 U	0.02 U
Sodium	mg/L	NP	NA	115 J	307 J	554 J	339 J	345 J
Thallium	mg/L	0.002	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NP	NA	NA	NA	NA	NA	NA
Uranium	mg/L	0.03	NA	0.0123	0.0223	0.0319	0.0702	0.0729
Vanadium	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
Zinc	mg/L	NP	NA	0.02 U	0.04 U	0.06 U	0.04 U	0.04 U
<b>Radiological</b>								
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	6.9 (+/- 0.9)	8.2 (+/- 1.2)	23.1 (+/- 1.7)	30.1 (+/- 2)	28.7 (+/- 2.1)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	8.3 (+/- 1.1)	10.1 (+/- 1.4)	28.5 (+/- 2.1)	36.1 (+/- 2.5)	37.3 (+/- 2.8)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	8.2 (+/- 1.2)	14.9 (+/- 1.6)	8.8 (+/- 1.4)	27.6 (+/- 2.2)	21.7 (+/- 2)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	8.5 (+/- 1.3)	15.3 (+/- 1.7)	8.9 (+/- 1.5)	28.6 (+/- 2.2)	21.8 (+/- 2)
Ra226, SDWA Method	pCi/L	5	30	0.17 (+/- 0.01)	0.25 (+/- 0.01)	0.04 (+/- 0.01)	0.06 (+/- 0.01)	0.07 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.33 (+/- 0.08)	0.14 U (+/- 0.07)	0.14 U (+/- 0.07)	0.14 U (+/- 0.08)	0.19 (+/- 0.08)
Radon	pCi/L	NP	NP	NA	NA	773 (+/- 149)	904 (+/- 174)	907 (+/- 175)
Radon 222	pCi/L	NP	NP	NA	496	NA	NA	NA
Radon 222 MDC	pCi/L	NP	NP	NA	100	NA	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	NA	64.5	NA	NA	NA
Thorium-228	pCi/L	NP	NP	NA	0.098 (+/- 0.298)	-0.149 (+/- 0.103)	-0.045 (+/- 0.227)	0.082 (+/- 0.167)
Thorium-230	pCi/L	NP	NP	NA	0.026 (+/- 0.201)	-0.083 (+/- 0.080)	-0.046 (+/- 0.180)	-0.029 (+/- 0.162)
Thorium-232	pCi/L	NP	NP	NA	0.073 (+/- 0.201)	-0.009 (+/- 0.042)	0.042 (+/- 0.180)	0.021 (+/- 0.162)
U234, by Alpha Spec	pCi/L	NP	NP	6.7 (+/- 0.2)	9.5 (+/- 0.27)	19.6 (+/- 0.6)	21.6 (+/- 0.63)	21.8 (+/- 0.63)
U238, by Alpha Spec	pCi/L	10	NP	3.6 (+/- 0.12)	5.7 (+/- 0.18)	8.4 (+/- 0.29)	16.8 (+/- 0.5)	16.1 (+/- 0.49)
Uranium, Mass Concentration	ug/L	30	NP	12 (+/- 1.2)	20 (+/- 2)	30 (+/- 3)	66 (+/- 6.6)	66 (+/- 6.6)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency.

An MCL is the legal threshold limit on the amount of a substance that is allowed in public drinking water.

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable to

groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants

NMWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-50 10/9/2014	LSM-51 10/8/2014	LSM-52 10/8/2014	LSM-53 10/8/2014	LSM-56 10/8/2014
<b>Dissolved Metals</b>								
Aluminum	mg/L	NA	0.1	0.2 U	0.2 U	0.2 U	0.3 U	0.2 U
Antimony	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	NA	NP	0.002	0.002 U	0.0181	0.002 U	0.002 U
Barium	mg/L	NA	1	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Beryllium	mg/L	NA	NP	0.01 U	0.01 U	0.01 U	0.015 U	0.01 U
Boron	mg/L	NA	NP	NA	NA	NA	NA	NA
Cadmium	mg/L	NA	0.01	0.01 U	0.01 U	0.01 U	0.015 U	0.01 U
Calcium	mg/L	NA	NP	193	203	416	315	478
Chromium	mg/L	NA	0.05	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Cobalt	mg/L	NA	NP	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Copper	mg/L	NA	1	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Iron	mg/L	NA	1	0.05 U	0.843	0.05 U	0.192	0.05 U
Lead	mg/L	NA	0.05	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Magnesium	mg/L	NA	NP	56.5	65.2	117	74.9	132
Manganese	mg/L	NA	0.2	0.01 U	0.0236	0.01 U	0.015 U	0.01 U
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.0661	0.0073	0.0123	0.002 U	0.002 U
Nickel	mg/L	NA	NP	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Potassium	mg/L	NA	NP	12.5 J	16.3 J	16.1 J	11.1 J	11.1 J
Selenium	mg/L	NA	0.05	0.0267	0.0192	0.252	0.0449	0.0205
Silver	mg/L	NA	0.05	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Sodium	mg/L	NA	NP	372 J	380 J	725 J	569 J	339 J
Thallium	mg/L	NA	NP	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NA	NP	NA	NA	NA	NA	NA
Uranium	mg/L	NA	0.03	0.154	0.0571	0.224	0.0624	0.0213
Vanadium	mg/L	NA	NP	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Zinc	mg/L	NA	10	0.04 U	0.04 U	0.04 U	0.546	0.04 U
<b>General Chemistry</b>								
Estimated Alkalinity	mg/L	NP	NP	888	787	527	824	0
Estimated Bicarbonate	mg/L	NP	NP	888	787	527	824	0
Calcium	mg/L	NP	NP	193	203	416	315	478
Carbonate	mg/L	NP	NP	NA	NA	NA	NA	NA
Chloride	mg/L	NP	250	146	178	567	236	45
Fluoride	mg/L	NP	1.6	0.25 U	0.25 U	0.25 U	0.25 U	0.51
Iron	mg/L	NP	NP	0.05 U	0.843	0.05 U	0.192	0.05 U
Magnesium	mg/L	NP	NP	56.5	65.2	117	74.9	132
Manganese	mg/L	NP	NP	0.01 U	0.024	0.01 U	0.0152	0.01 U
Nitrate as N	mg/L	1	10	1.94	1.66	16.4	3.54	17.2
Nitrate+Nitrite as N	mg/L	1	NP	1.94	1.67	16.4	3.53	17.2
Nitrite as N	mg/L	1	NP	0.0006 U	0.0006 U TQ02	0.0006 U	0.0006 U	0.0006 U
pH	pH Units	6.5-8.5	6-9	7.14	7.01	7.12	7.1	7.15
Potassium	mg/L	NP	NP	12.5 J	16.3 J	16.1 J	11.1 J	11.1 J
Sodium	mg/L	NP	NP	372 J	380 J	725 J	569 J	339 J
Sulfate	mg/L	250	600	567	685	1790	1270	2380
Total Dissolved Solids	mg/L	500	1000	2300	1960	3930	2870	3430
Total Hardness	mg/L	NP	NP	NA	NA	NA	NA	NA



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-50 10/9/2014	LSM-51 10/8/2014	LSM-52 10/8/2014	LSM-53 10/8/2014	LSM-56 10/8/2014
<b>Total Metals</b>								
Aluminum	mg/L	NP	NA	0.2 U	0.2 U	0.2 U	0.3 U	0.2 U
Antimony	mg/L	0.006	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Arsenic	mg/L	0.01	NA	0.0021	0.002 U	0.0161	0.002 U	0.002 U
Barium	mg/L	2	NA	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Beryllium	mg/L	0.004	NA	0.01 U	0.01 U	0.01 U	0.015 U	0.01 U
Boron	mg/L	NP	NA	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	NA	0.01 U	0.01 U	0.01 U	0.015 U	0.01 U
Calcium	mg/L	NP	NA	195	208	418	308	456
Chromium	mg/L	0.1	NA	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Cobalt	mg/L	NP	NA	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Copper	mg/L	1.3	NA	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Iron	mg/L	NP	NA	0.05 U	1.06	0.0625	0.686	0.05 U
Lead	mg/L	0.015	NA	0.002 U	0.002 U	0.002 U	0.0023	0.002 U
Magnesium	mg/L	NP	NA	57.4	68.4	119	74.1	128
Manganese	mg/L	NP	NA	0.01 U	0.024	0.01 U	0.0152	0.01 U
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.063	0.0068	0.0107	0.002 U	0.002 U
Nickel	mg/L	NP	NA	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Potassium	mg/L	NP	NA	14.1 J	19.4 J	19.2 J	12.6 J	12 J
Selenium	mg/L	0.05	NA	0.0267	0.018	0.247	0.0466	0.02
Silver	mg/L	NP	NA	0.02 U	0.02 U	0.02 U	0.03 U	0.02 U
Sodium	mg/L	NP	NA	398 J	429 J	804 J	620 J	361 J
Thallium	mg/L	0.002	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Total Hardness	mg/L	NP	NA	NA	NA	NA	NA	NA
Uranium	mg/L	0.03	NA	0.157	0.0588	0.228	0.0625	0.0208
Vanadium	mg/L	NP	NA	0.04 U	0.04 U	0.04 U	0.06 U	0.04 U
Zinc	mg/L	NP	NA	0.04 U	0.04 U	0.04 U	0.641	0.04 U
<b>Radiological</b>								
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	54.7 (+/- 3.2)	21.2 (+/- 1.7)	70.5 (+/- 4.9)	24.2 (+/- 2)	8.8 (+/- 1.3)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	68.1 (+/- 3.9)	26.9 (+/- 2.2)	108.2 (+/- 7.5)	32.6 (+/- 2.7)	12.2 (+/- 1.9)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	49.9 (+/- 3.2)	21.9 (+/- 2)	73 (+/- 5.1)	24.4 (+/- 2.1)	10.5 (+/- 1.7)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	50.8 (+/- 3.3)	22 (+/- 2)	68.2 (+/- 4.7)	24.3 (+/- 2.1)	10.4 (+/- 1.6)
Ra226, SDWA Method	pCi/L	5	30	0.03 (+/- 0.01)	0.03 (+/- 0.01)	0.09 (+/- 0.01)	0.18 (+/- 0.02)	0.07 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.14 U (+/- 0.08)	0.13 U (+/- 0.07)	0.36 U (+/- 0.19)	0.2 (+/- 0.07)	0.96 U (+/- 0.47)
Radon	pCi/L	NP	NP	NA	NA	NA	417.5 (+/- 88.3)	992 (+/- 188)
Radon 222	pCi/L	NP	NP	676	251	736	NA	NA
Radon 222 MDC	pCi/L	NP	NP	69.2	60.8	67.6	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	104	99	100	NA	NA
Thorium-228	pCi/L	NP	NP	0.016 (+/- 0.198)	-0.079 (+/- 0.195)	-0.038 (+/- 0.311)	0.001 (+/- 0.171)	0.043 (+/- 0.341)
Thorium-230	pCi/L	NP	NP	0.131 (+/- 0.187)	-0.02 (+/- 0.191)	0.302 (+/- 0.315)	-0.052 (+/- 0.168)	-0.102 (+/- 0.210)
Thorium-232	pCi/L	NP	NP	0.044 (+/- 0.186)	0.000 (+/- 0.191)	0.179 (+/- 0.225)	0.048 (+/- 0.168)	0.05 (+/- 0.216)
U234, by Alpha Spec	pCi/L	NP	NP	54.1 (+/- 1.66)	20.1 (+/- 0.62)	69.5 (+/- 2)	25.2 (+/- 0.76)	11.3 (+/- 0.41)
U238, by Alpha Spec	pCi/L	10	NP	40.5 (+/- 1.29)	15.5 (+/- 0.5)	58.2 (+/- 1.71)	16.7 (+/- 0.53)	6.1 (+/- 0.26)
Uranium, Mass Concentration	ug/L	30	NP	140 (+/- 14)	52 (+/- 5.2)	200 (+/- 20)	57 (+/- 5.7)	21 (+/- 2.1)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for  
Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency.

An MCL is the legal threshold limit on the amount of a substance that is allowed in public drinking water.

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable to groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants, the NMWQCC for Radiocactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-58 10/8/2014	LSM-60 1/7/2015	LSM-61 1/7/2015	LSM-62 1/7/2015
<b>Dissolved Metals</b>							
Aluminum	mg/L	NA	0.1	0.1 U	0.01 U	0.01 U	0.01 U
Antimony	mg/L	NA	NP	0.002 U	0.001 U	0.001 U	0.001 U
Arsenic	mg/L	NA	NP	0.002 U	0.002	0.004	0.002
Barium	mg/L	NA	1	0.0298	0.1 U	0.1 U	0.1 U
Beryllium	mg/L	NA	NP	0.005 U	0.001 U	0.001 U	0.001 U
Boron	mg/L	NA	NP	NA	1.8	0.07	0.27
Cadmium	mg/L	NA	0.01	0.005 U	0.001 U	0.001 U	0.001 U
Calcium	mg/L	NA	NP	74.6	15	85	510
Chromium	mg/L	NA	0.05	0.01 U	0.001 U	0.001	0.001 U
Cobalt	mg/L	NA	NP	0.02 U	0.001 U	0.001 U	0.001 U
Copper	mg/L	NA	1	0.02 U	0.01 U	0.01 U	0.01 U
Iron	mg/L	NA	1	0.101	0.05 U	0.05 U	0.087
Lead	mg/L	NA	0.05	0.002 U	0.001 U	0.001 U	0.001 U
Magnesium	mg/L	NA	NP	8.06	1.8	15	150
Manganese	mg/L	NA	0.2	0.037	0.008	0.062	0.017
Mercury	mg/L	NA	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NA	NP	0.007	0.026	0.001 U	0.003
Nickel	mg/L	NA	NP	0.02 U	0.01 U	0.01 U	0.014
Potassium	mg/L	NA	NP	5.7 J	NA	5	7
Selenium	mg/L	NA	0.05	0.004 U	0.005 U	0.064	0.006
Silver	mg/L	NA	0.05	0.01 U	0.001 U	0.001 U	0.001 U
Sodium	mg/L	NA	NP	38.5 J	681	58	NA
Thallium	mg/L	NA	NP	0.002 U	0.001 U	0.001 U	0.001 U
Total Hardness	mg/L	NA	NP	NA	45	270	1900
Uranium	mg/L	NA	0.03	0.0234	0.042	0.06	0.017
Vanadium	mg/L	NA	NP	0.02 U	0.008	0.001 U	0.001 U
Zinc	mg/L	NA	10	0.02 U	0.01 U	0.013	0.1
<b>General Chemistry</b>							
Estimated Alkalinity	mg/L	NP	NP	248	377 A	259 A	168 A
Estimated Bicarbonate	mg/L	NP	NP	248	371	259	168
Calcium	mg/L	NP	NP	74.6	15	85	510
Carbonate	mg/L	NP	NP	NA	5.84	0	0
Chloride	mg/L	NP	250	5 U	444	16	49.8
Fluoride	mg/L	NP	1.6	0.49	1.42 A	0.14 A	0.45 A
Iron	mg/L	NP	NP	0.101	0.05 U	0.05 U	0.087
Magnesium	mg/L	NP	NP	8.06	1.8	15	150
Manganese	mg/L	NP	NP	0.0376	0.007	0.053	0.018
Nitrate as N	mg/L	1	10	0.02	NA	NA	NA
Nitrate+Nitrite as N	mg/L	1	NP	0.04 U	0.69	1.16	15
Nitrite as N	mg/L	1	NP	0.0006 U	NA	NA	NA
pH	pH Units	6.5-8.5	6-9	7.46	8.37	7.97	7.63
Potassium	mg/L	NP	NP	5.7 J	NA	5	7
Sodium	mg/L	NP	NP	38.5 J	681	58	NA
Sulfate	mg/L	250	600	91	664	100	2030
Total Dissolved Solids	mg/L	500	1000	322	2080	444	3340
Total Hardness	mg/L	NP	NP	NA	NA	NA	1900

**Table 3: Lower San Mateo Creek Basin  
Sampling Analytical Results**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	LSM-58 10/8/2014	LSM-60 1/7/2015	LSM-61 1/7/2015	LSM-62 1/7/2015
<b>Total Metals</b>							
Aluminum	mg/L	NP	NA	0.1 U	0.019	0.02	0.01 U
Antimony	mg/L	0.006	NA	0.002 U	0.001 U	0.001 U	0.001 U
Arsenic	mg/L	0.01	NA	0.002 U	0.001	0.003	0.001 U
Barium	mg/L	2	NA	0.0311	0.1 U	0.1 U	0.1 U
Beryllium	mg/L	0.004	NA	0.005 U	0.001 U	0.001 U	0.001 U
Boron	mg/L	NP	NA	NA	1.6	0.07	0.28
Cadmium	mg/L	0.005	NA	0.005 U	0.001 U	0.001 U	0.001 U
Calcium	mg/L	NP	NA	72.3	13	76	520
Chromium	mg/L	0.1	NA	0.01 U	0.001 U	0.001 U	0.001 U
Cobalt	mg/L	NP	NA	0.02 U	0.001 U	0.001 U	0.001 U
Copper	mg/L	1.3	NA	0.02 U	0.01 U	0.01 U	0.01 U
Iron	mg/L	NP	NA	0.119	NA	NA	NA
Lead	mg/L	0.015	NA	0.002 U	0.001 U	0.001 U	0.001 U
Magnesium	mg/L	NP	NA	7.84	1.5	14	160
Manganese	mg/L	NP	NA	0.0376	0.007	0.053	0.018
Mercury	mg/L	0.002	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	mg/L	NP	NA	0.0067	0.026	0.001 U	0.003
Nickel	mg/L	NP	NA	0.02 U	0.01 U	0.01 U	0.016
Potassium	mg/L	NP	NA	6.41 J	NA	NA	NA
Selenium	mg/L	0.05	NA	0.004 U	0.005 U	0.057	0.005 U
Silver	mg/L	NP	NA	0.01 U	0.001 U	0.001 U	0.001 U
Sodium	mg/L	NP	NA	41.8 J	NA	NA	NA
Thallium	mg/L	0.002	NA	0.002 U	0.001 U	0.001 U	0.001 U
Total Hardness	mg/L	NP	NA	NA	38	250	2000
Uranium	mg/L	0.03	NA	0.023	0.046	0.054	0.019
Vanadium	mg/L	NP	NA	0.02 U	0.008	0.001 U	0.001 U
Zinc	mg/L	NP	NA	0.02 U	0.01	0.01	0.06
<b>Radiological</b>							
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	20.6 (+/- 2.1)	37.2 (+/- 2.5)	36.3 (+/- 3.7)	9.6 (+/- 1.3)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	25.6 (+/- 2.7)	48.8 (+/- 3.3)	46.9 (+/- 4.7)	13.3 (+/- 1.8)
Gross Beta w/ Cs-137 Reference	pCi/L	NP	NP	9.1 (+/- 1.7)	8.3 (+/- 1.9)	17.4 (+/- 2.7)	11.4 (+/- 1.7)
Gross Beta w/ Sr/Y-90 Reference	pCi/L	NP	NP	9.3 (+/- 1.7)	8.3 (+/- 1.8)	17.4 (+/- 2.7)	11.4 (+/- 1.7)
Ra226, SDWA Method	pCi/L	5	30	0.74 (+/- 0.03)	0.04 (+/- 0.02)	1.16 (+/- 0.04)	0.14 (+/- 0.01)
Ra228, SDWA Method	pCi/L	5	30	0.4 (+/- 0.08)	0.16 (+/- 0.08)	0.94 (+/- 0.12)	0.28 (+/- 0.09)
Radon	pCi/L	NP	NP	1314 (+/- 245)	495 (+/- 101)	55.8 (+/- 33.0)	779 (+/- 150)
Radon 222	pCi/L	NP	NP	NA	NA	NA	NA
Radon 222 MDC	pCi/L	NP	NP	NA	NA	NA	NA
Radon 222 Precision +/-	pCi/L	NP	NP	NA	NA	NA	NA
Thorium-228	pCi/L	NP	NP	0.068 (+/- 0.227)	0.189 (+/- 0.145)	0.026 (+/- 0.108)	-0.026 (+/- 0.111)
Thorium-230	pCi/L	NP	NP	0.04 (+/- 0.172)	0.217 (+/- 0.124)	-0.017 (+/- 0.072)	-0.043 (+/- 0.057)
Thorium-232	pCi/L	NP	NP	0.013 (+/- 0.167)	0.070 (+/- 0.077)	0.009 (+/- 0.045)	-0.061 (+/- 0.052)
U234, by Alpha Spec	pCi/L	NP	NP	16.5 (+/- 0.45)	37.1 (+/- 1.2)	28.9 (+/- 0.8)	7.4 (+/- 0.27)
U238, by Alpha Spec	pCi/L	10	NP	6.5 (+/- 0.19)	11.5 (+/- 0.45)	18.3 (+/- 0.52)	4.29 (+/- 0.18)
Uranium, Mass Concentration	ug/L	30	NP	22 (+/- 2.2)	44 (+/- 4.4)	61 (+/- 6.1)	18 (+/- 1.8)

Notes:

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

TQ02 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken

TQ03 - Sample received at laboratory with insufficient holding time remaining to conduct analysis for Sample collector was notified. Analysis was performed per collector's request. No further corrective action was taken.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency

An MCL is the legal threshold limit on the amount of a substance that is allowed in public drinking water. Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NMWQCC) Health-based standards applicable to groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants, NMWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.

**Table 4: Lower San Mateo Creek Basin  
Comparison to Historical Data**

Analyte	Units	National Primary Drinking Water Standard Maximum Contaminant Level (MCL)	New Mexico Water Quality Control Commission (NMWQCC)	SMC-13 4/2/2009	LSM-34 10/7/2014	SMC-10 3/30/2009	LSM-35 10/7/2014	SMC-25 3/30/2009	LSM-56 10/8/2014	SMC-20 3/31/2009	LSM-61 1/7/2015
<b>Dissolved Metals</b>											
Calcium	mg/L	NA	NP	389	362	567	143	64.9	478	92.3	85
Iron	mg/L	NA	1	0.025	0.075 U	0.025	0.896	0.025	0.05 U	0.025	0.05 U
Magnesium	mg/L	NA	NP	73.7	70.1	149	30.5	8.26	132	15.8	15
Manganese	mg/L	NA	0.2	0.0115	0.015 U	0.005	0.0691	0.005	0.01 U	0.057	0.062
Potassium	mg/L	NA	NP	8.44	14.8 J	6.95	4.68 J	1.01	11.1 J	5.9	5
Selenium	mg/L	NA	0.05	0.618	0.658	0.0321	0.0229	0.0132	0.0205	0.0736	0.064
Sodium	mg/L	NA	NP	355	483 J	261	421 J	102	339 J	67.9	58
Uranium	mg/L	NA	0.03	0.24	0.238	0.0309	0.0065	0.0206	0.0213	0.0639	0.06
<b>General Chemistry</b>											
Estimated Bicarbonate	mg/L	NP	NP	180	526	170	332	181	0	260	259
Carbonate	mg/L	NP	NP	10	NA	10	NA	10	NA	10	0
Chloride	mg/L	NP	250	59	49	47	64	26	45	15	16
Fluoride	mg/L	NP	1.6	0.5	0.25 U	0.56	0.25 U	1.4	0.51	0.25	0.14 A
Nitrate+Nitrite as N	mg/L	1	NP	18.6	17	21.2	1.04	5.7	17.2	1.08	1.16
Sulfate	mg/L	250	600	1610	1670	2110	994	144	2380	96	100
Total Dissolved Solids	mg/L	500	1000	2710	2940	3380	1900	504	3430	504	444
<b>Total Metals</b>											
Arsenic	mg/L	0.01	NA	0.0377	0.0349	0.002U	0.002 U	0.0112	0.002 U	0.005	0.003
Selenium	mg/L	0.05	NA	0.604	0.654	0.0314	0.0249	0.0133	0.02	0.074	0.057
Uranium	mg/L	0.03	NA	0.24	0.24	0.0305	0.0066	0.0215	0.0208	0.066	0.054
<b>Radiological</b>											
Gross Alpha w/ Am-241 Reference	pCi/L	15	NP	NA	87.8 (+/- 5)	NA	3.9 (+/- 0.8)	NA	8.8 (+/- 1.3)	NA	36.3 (+/- 3.7)
Gross Alpha w/ U-nat Reference	pCi/L	15	NP	NA	116.9 (+/- 6.6)	NA	5.1 (+/- 1)	NA	12.2 (+/- 1.9)	NA	46.9 (+/- 4.7)
U234, by Alpha Spec	pCi/L	NP	NP	75.8 (+/- 6.2)	75.2 (+/- 2.06)	0.1 (+/- 0.09)	2.3 (+/- 0.12)	NA	11.3 (+/- 0.41)	30.4 (+/- 2.7)	28.9 (+/- 0.8)
U238, by Alpha Spec	pCi/L	10	NP	64.3 (+/- 5.3)	60.2 (+/- 1.72)	0.04 (+/- 0.06)	1.6 (+/- 0.1)	NA	6.1 (+/- 0.26)	17.4 (+/- 1.7)	18.3 (+/- 0.52)
Uranium, Mass Concentration	ug/L	30	NP	NA	210 (+/- 21)	NA	6 (+/- 0.6)	NA	21 (+/- 2.1)	NA	61 (+/- 6.1)

**Notes:**

U - Analyte not detected

NA - Not Applicable

NP - Not Published

J - The identification of the analyte is acceptable; the reported value is an estimate

A - This sample was extracted at a single acid pH.

mg/L - milligrams per Liter. Milligrams per Liter are equivalent to parts per million.

ug/L - micrograms/Liter. Micrograms per Liter are equivalent to parts per billion.

pCi/L - picocuries per Liter

Maximum Contaminant Levels (MCLs) are standards that are set by the United States Environmental Protection Agency (EPA) for drinking water quality.

An MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act.

Alkalinity and Bicarbonate estimated by Anion and Cation Balance Calculation

New Mexico Water Quality Control Commission Standard (NWQCC) Health-based standards applicable to

groundwater with less than 10,000 mg/L Total Dissolved Solids (TDS). For metals contaminants, these standards apply to dissolved metals.

NWQCC for Radioactivity: Combined Radium-226 and Radium-228 standard is 30 pCi/L.



## Attachment A

Private Well Use Surveys,  
Water Rights Reporting System (WRRS) Information,  
and Well Records (if available)

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# TARGET SHEET

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**CERCLIS I.D.:** NMN000606847

**TITLE OF DOC.:** ATTACHMENT A - PRIVATE WELL USE  
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# **Site Status Report: Groundwater Flow and Contaminant Transport in the Vicinity of the Bluewater, New Mexico, Disposal Site**

**November 2014**



**U.S. DEPARTMENT OF  
ENERGY**

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- Plate 2 Geologic Map of the Study Area
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DOE assumed responsibility for the Bluewater mill site in 1997 after the State of New Mexico declined to take over long-term management duties. DOE manages the site in accordance with an NRC-approved Long-Term Surveillance Plan (LTSP) to ensure protection of human health and the environment. Requirements of the LTSP (DOE 1997) include ensuring that reclaimed features at the facility (disposal cells and landfills) function as designed and that onsite groundwater chemistry meets approved water quality standards.

### **2.2.3 Historical Site Groundwater Issues**

Anaconda became aware as early as the late 1950s that contaminated mill process water from the main tailings impoundment was impacting the alluvial and San Andres aquifers (West 1972). This observation was supported further in consulting reports produced in the late 1970s by Hydro-Search (1977, 1981a), and again in the early- to mid-1980s in reports by Dames & Moore (1986a, 1986b).

Downward seepage of liquids from sandy and clay-rich tailings in the main tailings impoundment to underlying geologic units was considered to be the source of the contamination in the aquifers beneath and near the impoundment. ARCO estimated that approximately 5.7 billion gallons of tailings fluids seeped from the main tailings impoundment prior to encapsulation in 1995, with about 2.7 billion gallons occurring prior to 1960 when deep-well injection began. These seepage estimates are described in greater detail in Chapter 6 and Appendix A.

Contaminated groundwater in the alluvial aquifer resulted from downward seepage from both tailings piles through underlying porous basalt and into the buried sand and gravel deposits of the ancestral Rio San Jose. The contaminated alluvial groundwater was then transported southeastward, mostly within the Rio San Jose paleodeposits.

Downward-seeping contaminants from the main tailings impoundment also entered the San Andres aquifer, particularly where the base of the southeast portion of the impoundment directly contacts the San Andres Limestone. Additionally, some of the contamination in the San Andres aquifer was caused by tailings liquids that first migrated through a thin layer of basalt in direct contact with the tailings, and then to limestone and sandstone in the bedrock. It is also possible that some tailings leachate feeding ancestral Rio San Jose alluvium south of the impoundment subsequently migrated northeastward into the San Andres aquifer east of the main tailings impoundment.

The role that faults in the vicinity of the tailings played in affecting groundwater flow and contaminant transport during and shortly after milling years was not fully understood at the time. A north-striking fault (Ambrosia Lake Fault), which bisects the bedrock formations under the main tailings impoundment, is known to intersect an east-striking fault (East-West Fault) under the south side of the main tailings impoundment. Though both features may represent partial barriers to San Andres aquifer groundwater flow, each also likely acts as a conduit, helping to convey groundwater vertically from alluvium to the San Andres aquifer as well as horizontally along the fault zone.

During the milling period, some contamination was detected in the San Andres aquifer as far as 0.75 mi directly south of the main tailings impoundment (i.e., south of the East-West Fault). In particular, uranium and nitrate concentrations above background levels were detected in



Anaconda #2 water-supply well used by Anaconda for milling. Anaconda pumped this well and

other San Andres aquifer production wells south of the mill (Anaconda #1, #3, #4, and #5 shown in Figure 4), creating a cone of depression that had the potential to induce southward flow of groundwater in the San Andres aquifer. It appears likely that the Ambrosia Lake Fault provided a conduit for the southward transport of contaminants from seepage from the main tailings impoundment. However, ARCO did not consider contamination in the San Andres aquifer south of the East-West Fault to be of concern because a downgradient private well (Sabre-Piñon well, currently known as HMC-951) had background uranium concentrations. ARCO assumed that incoming fresh groundwater was diluting the contaminants to acceptable concentrations.

In 1989, ARCO began pumping groundwater from the alluvial and San Andres aquifers using wells located around the perimeter of the main tailings impoundment as part of an effort to reduce local contaminant concentrations to background levels. This attempt at remediation proved unsuccessful, as no reductions in constituent concentrations were observed. As a consequence, ARCO recommended establishing alternate concentration limits (ACLs) for the two aquifers (Applied Hydrology Associates Inc. 1990, 1995) Subsequently, NRC approved ACLs for uranium of 0.44 mg/L and 2.15 mg/L for point-of-compliance wells in the alluvial aquifer and San Andres aquifer, respectively. These approved levels were significantly below the New Mexico drinking water standard for uranium at the time, which was 5 mg/L. In 2004, New Mexico adopted the U.S. Environmental Protection Agency (EPA) drinking water MCL for uranium of 0.03 mg/L for groundwater. Consequently, the current MCL for uranium is significantly below the former MCL, which ARCO was required to meet, and substantially below the approved ACLs.

Assessments made by ARCO in the 1990s indicated that the highest uranium concentrations at the site would be observed in the San Andres aquifer north of the East-West Fault, and that uranium concentrations would continue to meet health-based requirements (<5 mg/L) beyond the site's east boundary. Sample data from recent years at wells along the east boundary indicate that ARCO's expectations are being met but that groundwater leaving the site exceeds the current uranium MCL.

#### **2.2.4 Historical Groundwater Monitoring**

Anaconda and ARCO monitored an extensive network of onsite and private offsite wells. ARCO decommissioned many of the onsite wells prior to transferring the site to DOE. Consequently, DOE inherited only nine of the ARCO onsite monitoring wells (Table 1), which were considered to be sufficient by ARCO and NRC to ensure regulatory compliance in the alluvial and San Andres aquifers. The LTSP (DOE 1997) lists these nine wells and associated monitoring requirements. Since 1997, groundwater quality issues have led DOE to install an additional 10 wells at the site. DOE continues to monitor all of the wells for the purpose of protecting human health and the environment. Although the water quality monitoring accounts for multiple contaminants, uranium is the sole constituent that exceeds regulatory standards at onsite wells. Uranium concentrations exceed the ACL in one alluvial well and exceed the MCL in both aquifers in several wells located in the east and south portions of the site.

To assess the history of uranium concentrations at wells screened in the San Andres aquifer near the Homestake site, a temporal plot of concentrations at Homestake well locations 928, #1 Deep Well, #2 Deep Well, well 806, well 943, and well 951R was prepared (Figure 60). This graph suggests that the uranium concentration at well 928 has fluctuated between 0.035 and 0.105 mg/L since 1980. In contrast, concentrations in #1 Deep Well have been steady at about 0.01 mg/L, and uranium levels in well 806 have also remained steady, between about 0.01 and 0.02 mg/L. Other than an anomalously high concentration of 0.47 mg/L in 2009, uranium levels at #2 Deep Well have stayed within a range of about 0.01 to 0.03 mg/L (Figure 60). Uranium concentrations in well 943 have occasionally increased as high as 0.07 mg/L in recent years. Collectively, the historical concentrations could be considered relatively stable and representative of attenuated uranium contamination in portions of a plume that originates at the Bluewater site and extends some distance east of the Homestake site. With such a conceptualization, the leading edge of the uranium plume, as defined by a concentration of 0.01 mg/L is expected to be hydraulically downgradient of the Homestake site, in the direction of areas north of Grants.

The difficulties mentioned above concerning obstacles to acquiring contaminant concentrations representative of groundwater conditions in the San Andres aquifer serve as lessons that can potentially be applied to the monitoring of wells at other LM sites. Specifically, it is important to examine all historical monitoring data for a site before LM takes responsibility for the long-term surveillance activities at the site. Periodic inspection of the variation in contaminant concentrations with depth in each monitoring well could also be beneficial, as would occasional video logs of the wells. It would also be helpful to compare the results of low-flow sampling with those from well purge sampling to ensure that the most representative concentration data are being collected. Finally, occasional critical assessments of the temporal concentration histories at individual wells, as discussed above, would help confirm the validity of data presented in annual monitoring reports.

### 8.3.3 Uranium Concentrations at Municipal Wells

Though the uranium plume maps shown in Figure 55 through Figure 58 indicate that uranium contamination in the San Andres aquifer has migrated eastward from the Bluewater site to the Homestake site, none of the maps imply that uranium has migrated west-southwest to Bluewater Village, or directly within the San Andres aquifer to Milan. However, Section 8.2.1 discussed the possibility that uranium-contaminated alluvial groundwater had migrated to an area near Toltec and was subsequently transported downward to parts of the aquifer tapped by Milan Well #4. To assess whether uranium contamination has affected groundwater withdrawn by the municipal wells, this study examined the full suite of historical uranium concentrations measured at drinking-water supply wells in the Grants-Bluewater Valley. Figure 61 illustrates these data, as published in databases maintained by the New Mexico Drinking Water Bureau

As Figure 61 shows, uranium concentration data are available for community water-supply wells from various samples collected between 1997 and 2011. None of the posted concentrations exceed the uranium MCL of 0.03 mg/L, and most of the measured concentrations are less than 0.01 mg/L. The few cases in which the uranium concentration exceeds 0.01 mg/L are for samples



collected from Milan Well B-50 (Milan Well #4) and Milan Well B-35 (Milan Well #3) during the 1990s. In general, the results shown in Figure 61 suggest that uranium contamination has not

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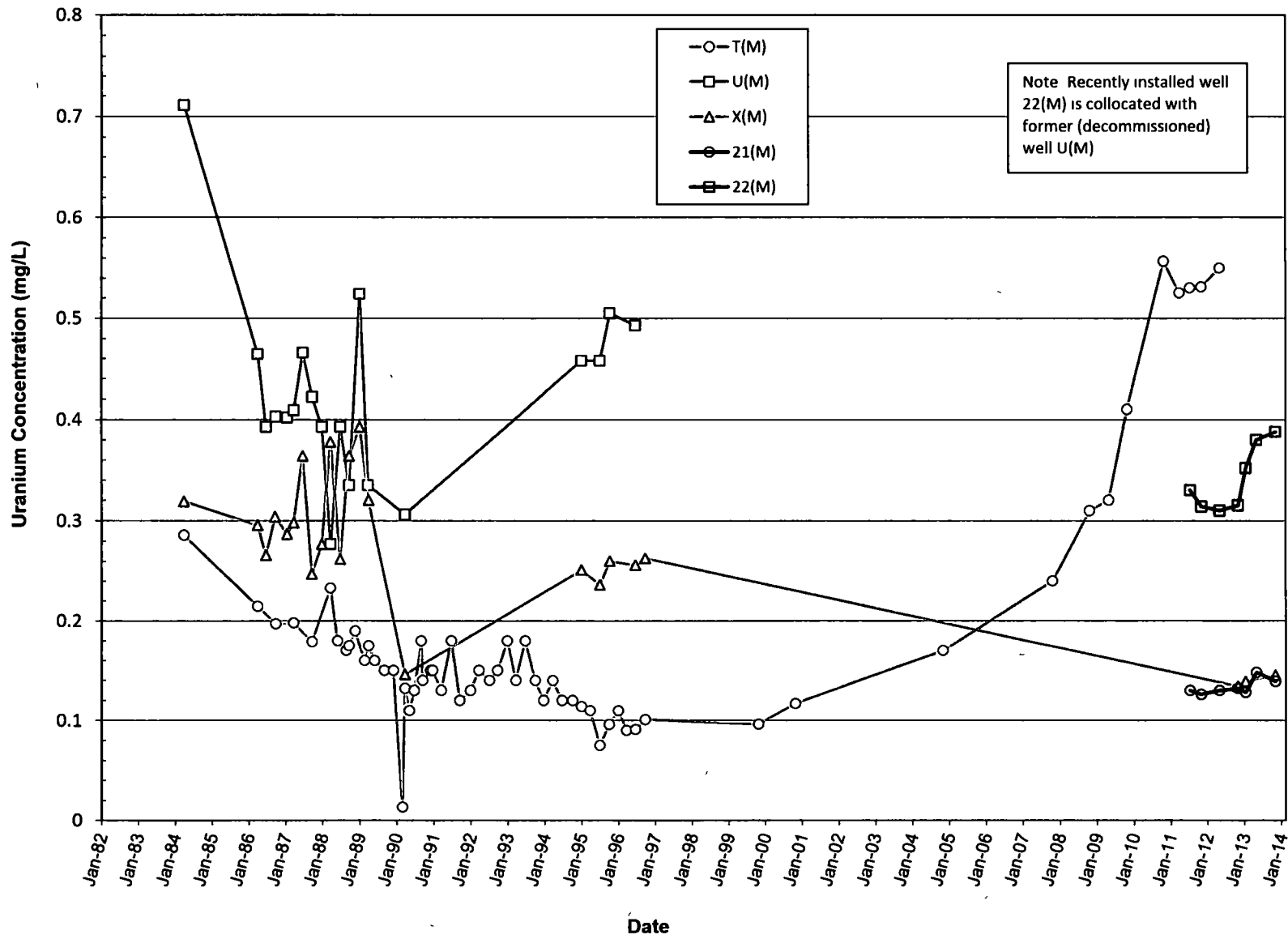


Figure 54. Temporal Plot of Uranium Concentrations in Alluvial Aquifer Wells at the Bluewater Site



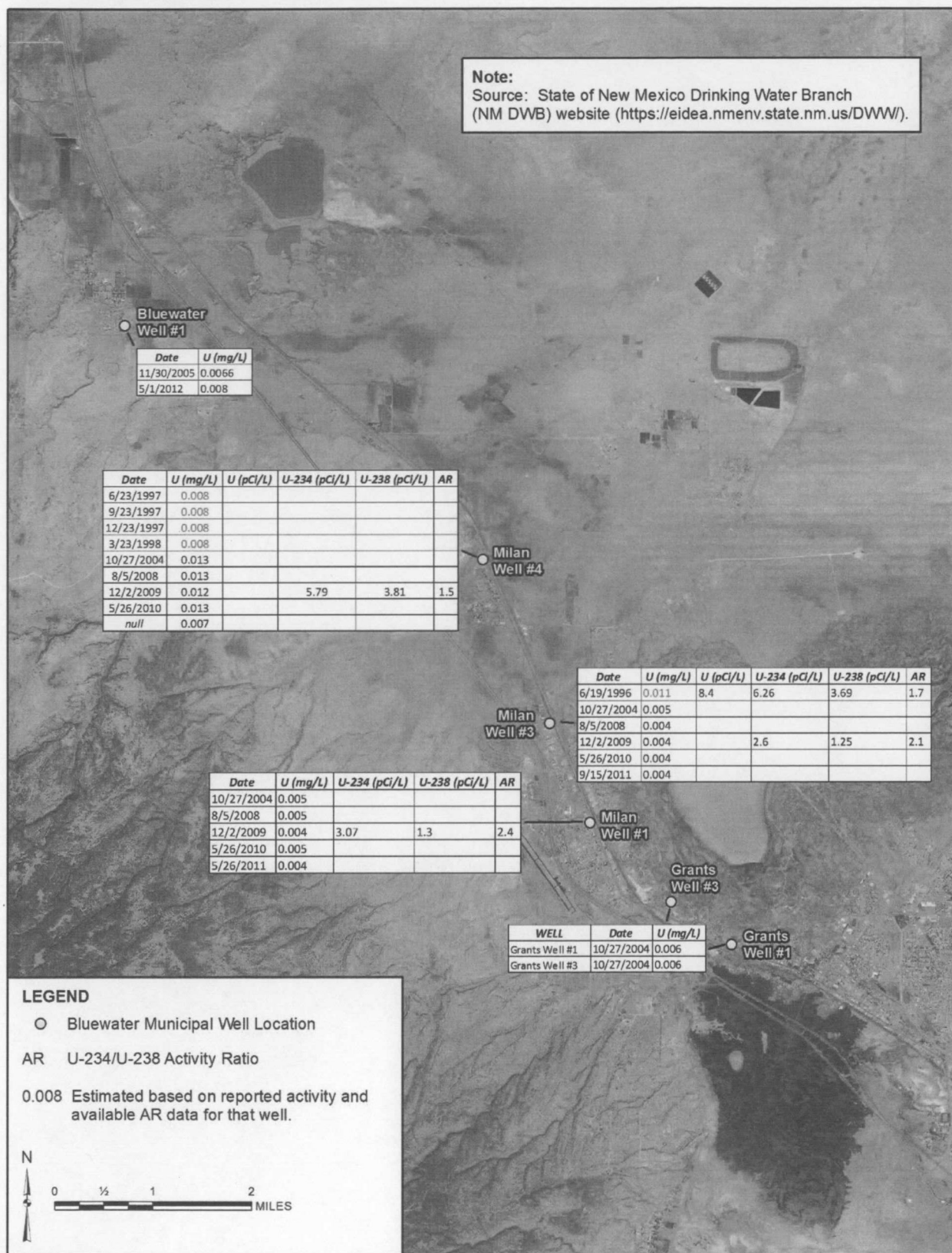


Figure 61. Uranium Concentration Data for Municipal Wells in the Grants-Bluewater Valley



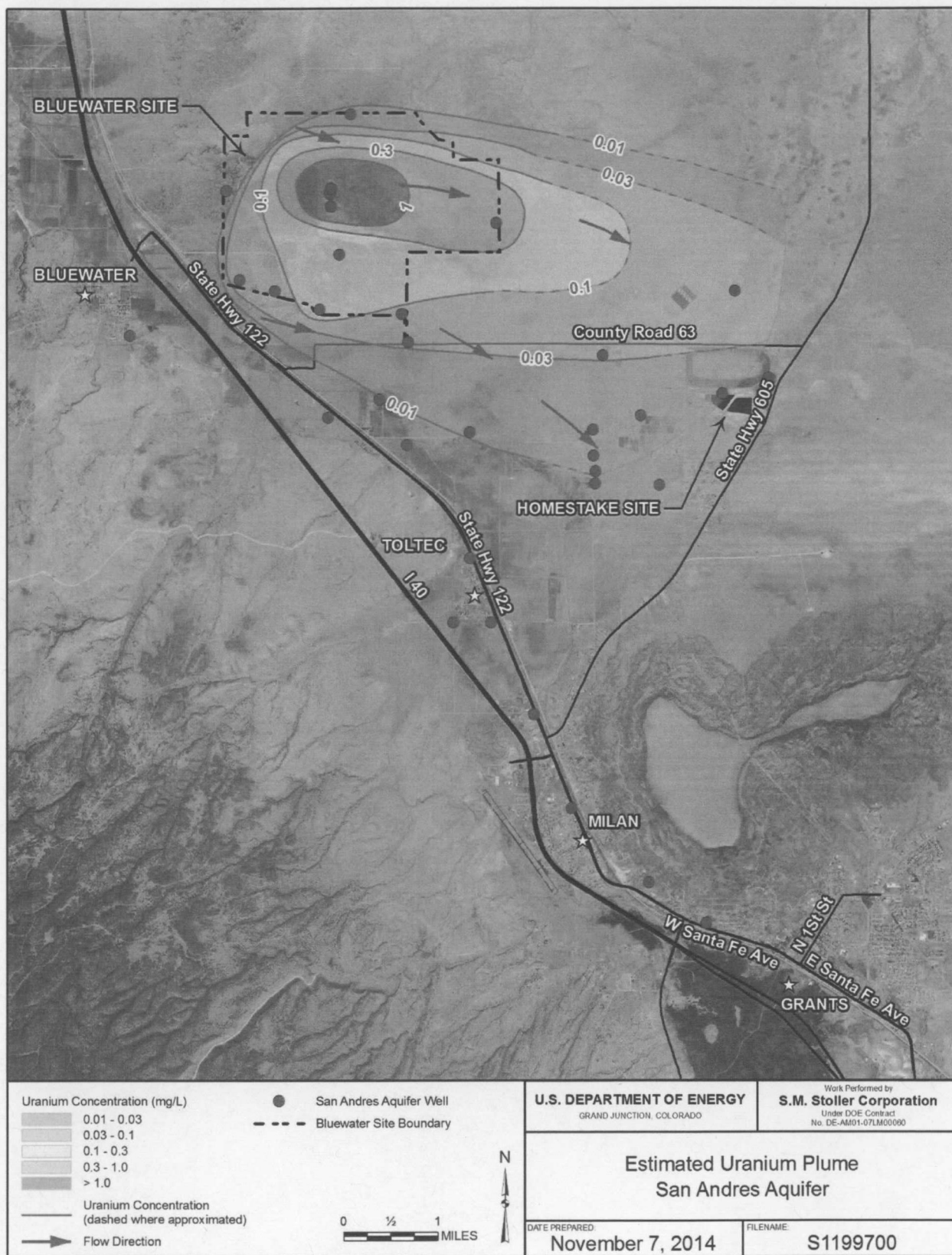


Figure 63. Current Estimated Uranium Plume in the San Andres Aquifer





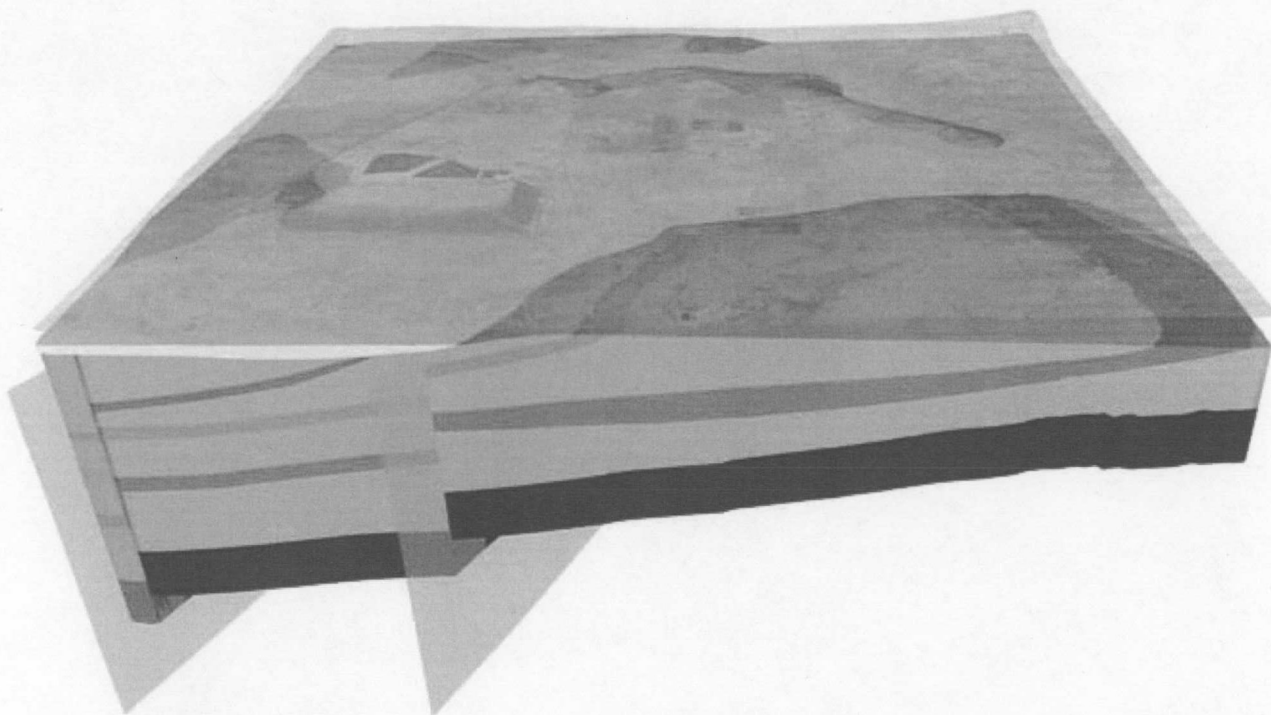
Table 17 (continued) Uncertainties and Their Effects on Study Conclusions

Conclusion	Uncertainty	Effect on Conclusion	Significance of Uncertainty
San Andres aquifer flow and uranium transport processes between the Homestake site and Grants are assumed to be similar to those between the Bluewater and Homestake sites	No San Andres wells are present between the Homestake site and Grants, so flow and uranium transport processes in that region are unknown	The leading edge of the uranium plume (the 0.01 mg/L contour) could be farther advanced toward areas north of Grants than currently estimated	Uranium concentrations in the Grants municipal supply wells do not show effects of mill-related contamination. DOE is committed to expend resources whenever a clear nexus to radiological safety is established, and will maintain a continuing dialog with NRC and NMED for ways to improve our common understanding of the groundwater flow and contaminant transport in the Grants-Bluewater Valley.
<b>Potential Risk to Groundwater Users</b>			
Assuming current San Andres aquifer use remains the same, the Milan and Grants municipal water supply wells will continue to have uranium concentrations below the drinking water standard	Pumping from high-production municipal, industrial, and irrigation wells could influence regional flow patterns in the San Andres aquifer, but the degree to which this pumping could influence flow is unknown	Pumping from the Anaconda production wells altered San Andres flow patterns, the natural flow direction has recovered since pumping ceased. It is possible that increased pumping south of the estimated uranium plume could draw San Andres aquifer groundwater and its contaminants to the south where it could impact municipal supply wells.	To date, pumping south of the plume appears to have little effect on regional groundwater flows. However, if declines in regional San Andres water levels continue, and/or pumping increases, there is a possibility of an adverse effect on the municipal groundwater supply.
<u>Although uranium concentrations in Milan's municipal wells are expected to remain below the drinking water standard, water in their northwesternmost well appears to be impacted by mill-related contaminants.</u> Uranium concentrations are greater than the adopted background concentration of 0.01 mg/L, and the U-234/U-238 activity ratio may suggest the presence of processed uranium.	Insufficient analyses have been conducted to verify the presence of processed uranium in the Milan well water.	<u>If processed uranium is present in the Milan well water, it would be difficult to determine the source of the uranium. Pumping by the Milan wells and other San Andres aquifer wells in the area appears to have reversed the hydraulic gradient between the alluvial aquifer and the San Andres aquifer in the vicinity of the Milan wells. If this has occurred, then the processed uranium could be derived from the contaminated San Mateo Creek alluvial aquifer as alluvial water is drawn down into the San Andres aquifer by pumping.</u>	Although slightly above background, the uranium concentrations in Milan's water supply wells are well below the drinking water standard and have not shown upward trends, therefore, the water is safe to drink. If the GRP is successful and if uranium concentrations in the Milan municipal wells remain steady or decline, then additional analyses of the hydrology and hydraulics of the aquifers in the vicinity of Milan's wells may be unnecessary.

# **GRANTS RECLAMATION PROJECT UPDATED CORRECTIVE ACTION PROGRAM (CAP)**

*Prepared for:*

**NUCLEAR REGULATORY COMMISSION**



*Prepared by:*

**Homestake Mining Company of California**

P.O. Box 98 – State Highway 605

Grants, New Mexico 87020

NRC Radioactive Material License SUA-1471



**March 2012**

**GRANTS RECLAMATION PROJECT  
UPDATED CORRECTIVE ACTION  
PROGRAM (CAP)**

*Prepared for*

**NUCLEAR REGULATORY COMMISSION**

*Prepared by*

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about the quality of groundwater for domestic use. The Land Use Review/Survey in the 2010 Annual Report investigated whether residents in the subdivisions used Milan water during 2010 by consulting a residential customer database. There were two residences in and adjacent to the Valle Verde subdivision that were not connected to the Village of Milan water supply system. One resident hauled water to the residence for domestic use and did not use a private well; the other is currently on a private well but plans are to connect this resident to the Milan water supply system soon. There are three other pending residential hookups to the Village of Milan water supply system located in proximity to Highway 605, approvals to complete these hookups are presently underway.

The radiation dose to the public associated with land treatment has been modeled and is presented in the 2000-2010 Irrigation Evaluation Report (HMC et al. 2011), which is also included as **Attachment J-1** in **Appendix J**. In the worst-case scenario, the radiation dose is less than 1 percent of the dose from natural background and medical exposures.

### **2.3 Operational History**

Uranium milling operations occurred at the site from 1958 to 1990. There were originally two separate mills operated as two distinct partnerships: the larger mill was organized under Homestake-Sapin Partners, with a nominal milling capacity of 1,750 tons per day (tpd). The smaller mill was organized under Homestake-New Mexico Partners, with a nominal milling capacity of 750 tpd. They operated independently, and each had separate tailings piles. The two milling facilities were combined and expanded in 1961 for a total nominal milling capacity of 3,400 tpd. The surviving organization was Homestake-Sapin. Both mills were designed to be alkaline leach/caustic precipitation processes for concentrating uranium oxide from ores with average grades of 0.05 to 0.30 percent  $U_3O_8$ . A detailed summary of the mill operation, including process chemistry and tailings characteristics, is provided in **Appendix B**.

In 1968, United Nuclear Corporation acquired an interest in the partnership, and the operation became known as United Nuclear-Homestake Partners. United Nuclear Corporation's interest was purchased by HMC in March 1981, and the operation became Homestake Mining Company-Grants. In 2001, HMC merged with Barrick Gold Corporation as a wholly-owned subsidiary.

Two tailings piles were developed on the site. The first and smaller of the two piles is called the Small Tailings Pile (STP) and the larger is called the Large Tailings Pile (LTP). The STP contains tailings from ore milled under contracts with the federal government. The total quantity of tailings placed in the STP was 1.22 million tons. Tailings deposited within this pile were contained entirely by an embankment.

*Updated Corrective Action Program*

composed of compacted natural soils. The embankment was compacted by heavy equipment and raised to a height of 20 to 25 feet. The crest was a minimum of 10 feet wide and the base approximately 40 feet wide. The STP covers an area of about 40 acres. In 1990, an evaporation pond (EP-1) was constructed within the footprint of the STP to assist in the dewatering of the LTP and to hold water pumped from the collection wells associated with the CAP. More recently, this evaporation pond, along with other lined ponds constructed nearby, have been used to evaporate the brine from the reverse osmosis (RO) water treatment plant and other wastewater generated as part of the CAP. The evaporation component of the CAP is discussed in **Section 5.3.4**.

The LTP contains tailings from ore milled under both federal government and commercial contracts for a total of 21.05 million tons of tailings, 11.41 million tons was generated under U.S Atomic Energy Commission (AEC) contracts, and 10.89 million tons from commercial contracts. Originally, HMC deposited tailings into only one cell of the LTP. In 1966, HMC added a cell adjacent to and west of the existing cell. From 1966 until 1990, tailings disposal alternated between the two cells to maintain optimal operating conditions. The starter dike for the LTP was constructed in compacted 6-inch lifts of natural soils excavated from within the tailings pile area. The starter dike was constructed to a height of approximately 10 feet and a width of approximately 10 to 15 feet at the crest and 25 to 30 feet at the base. The perimeter dike was raised using the centerline method until 1981, when an inboard offset of the embankment was made to improve stability. Subsequent lifts were added to the offset perimeter dike by the centerline method. The LTP covers approximately 234 acres, and the top varies between 70 feet to 90 feet above the toe of the LTP.

The tailings piped to the LTP were separated by the cyclone method and deposited through spigotting throughout most of the milling operation. Cycloning separated the coarse fraction (sands), as the underflow, from the fine fraction (slimes), as the overflow. The sands were deposited downstream of the dike crest along the centerline to raise the pile, and the slimes were deposited upstream of the dike crest toward the pond center of each cell. Detailed information about the grain size and geotechnical characteristics of the tailings is included in **Appendix B**. The tailings liquid was recovered through two decant towers for reuse as mill process water. When production rates were low during the latter stages of mill operations, cyclone separation was not used; the tailing slurry was discharged directly across the beaches into the tailings pond. This method of operation confined disposal to a single pond at a time, with the other pond used for evaporation as needed. Milling and deposition of tailings ended in 1990

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Interim reclamation of the LTP was completed in 1995, with the side slopes graded to a 5:1 horizontal to vertical slope and covered with 3 feet of compacted radon barrier material (sandy clay) and 8 inches of



**NEW MEXICO ENVIRONMENT DEPARTMENT**  
**GROUND WATER QUALITY BUREAU**

**GROUND WATER DISCHARGE PERMIT DP-200 RENEWAL AND**  
**MODIFICATION**

**Approval date:** September 18, 2014

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## DESCRIPTION OF SITE FACILITIES

The Site is located approximately five miles north of the City of Milan in Cibola County, New Mexico. The Site is situated at 35.15 degrees North latitude and 107.52 degrees West longitude, in Sections 25, 26, 27, 28, 33, 34, 35, Township 12 North, Range 10 West; and Sections 2 and 3, Township 11 North, Range 10 West. Tailings from two uranium recovery mills were discharged to two unlined tailings impoundments from 1958 to 1990. Milling operations ceased in 1990, whereupon the milling facilities were decommissioned and demolished as part of the millsite reclamation work required under the NRC Source Materials License SUA-1471. HMC constructed the synthetically-lined East Collection Pond (ECP) and West Collection Pond (WCP) in 1986, Evaporation Pond 1 (EP-1) in 1990, Evaporation Pond 2 (EP-2) in 1996, and Evaporation Pond 3 (EP-3) in 2010. Additional facilities currently at the millsite include two tailings impoundments, a tailings flushing and dewatering system, ground water collection and injection systems, an RO water treatment plant, two pilot zeolite bed treatment systems, two pilot tripolyphosphate injection (TPP) treatment systems, four land application areas, and associated equipment and structures.

## DESCRIPTION OF THE DISCHARGE

Ongoing leachate seepage from the two tailings impoundments and discharges from mill operations has resulted in contamination of ground water within the Alluvial aquifer, as well as within three underlying ground water aquifers within the Chinle Formation (e.g., Upper, Middle, and Lower Chinle aquifers) that are hydrologically-connected to the Alluvial aquifer through stratigraphic subcrops. Impacted ground water exceeds ground water quality standards under Section 20.6.2.3103.A NMAC for nitrate, selenium, uranium, and combined radium-226 plus radium-228; standards under Section 20.6.2.3103.B NMAC for chloride, sulfate and total dissolved solids (TDS); and standards under Section 20.6.2.3103.C NMAC for molybdenum, as well as existing background concentrations as shown in Table 1.

Activities and operational facilities associated with ongoing ground water abatement activities that produce discharges, which may move directly or indirectly into ground water, include operation of contaminated ground water collection systems, an RO water treatment plant, five existing collection and evaporation ponds, and alternate water treatment technology facilities to treat contaminated ground water; flushing of the Large Tailings Pile (LTP) to reduce source contaminant concentrations; and injection to impacted areas of the Alluvial and three Chinle aquifers to drive contaminated ground water toward collection wells. Each of these components is discussed in more detail below:

- Contaminated ground water collection systems: The collection of contaminated ground water for treatment or disposal is currently the primary Site activity. The majority of collected contaminated ground water is transported by pipeline for treatment by RO, discharge to evaporation ponds, or seasonal discharge to the land surface of the Approved Plots. In addition, some contaminated ground water from the Alluvial aquifer, which meets concentration limits specified herein, is injected within the Alluvial aquifer hydraulic control area to assist with initial

designated as Discharge Permit DP-1751, for continued seasonal land application of ground water and the potential implementation of alternate contaminated water treatment technologies to be employed during the non-irrigation season. This discharge permit application was not acted upon; the activities that were outlined in this application are to be regulated under the renewal/modification of this discharge permit.

### PERMIT MODIFICATIONS

DP-200 addresses the operational conditions under which HMC shall conduct activities to abate ground water contamination at the Site until ground water quality standards are achieved in accordance with 20.6.2.4000 NMAC. This renewal of DP-200 includes the following modifications:

- Authorization to increase Site total treatment capacity and discharge to 5,500 gpm (i.e., 7,920,000 gallons per day), from the current rates of 1,728,000 gallons per day (i.e., 1,200 gpm) authorized under Discharge Permit DP-200 and 1,166,000 gallons per day (i.e., 810 gpm) under Discharge Permit DP-725;
- Incorporation of the requirements of Discharge Permit DP-725, which is subsumed within DP-200;
- Authorization for continuation of LTP flushing to reduce the ground water contaminant source term;
- Authorization to continue ongoing pilot testing of alternate ground water treatment technologies, including *ex-situ* zeolite bed and EC, and *in-situ* TPP uranium fixation;
- Authorization to increase evaporative capacity.

## II. Findings

In issuing this Discharge Permit renewal and modification, NMED finds:

1. Effluent or leachate from former Site operations has moved directly or indirectly into ground water within the meaning of 20.6.2.3104 NMAC, resulting in exceedance of ground water standards promulgated in 20.6.2.3103 NMAC within the Site covered under this Discharge Permit;
2. Ground water that has been impacted by the movement of such effluent or leachate from the former Site operations has an existing concentration of total dissolved solids that is equal or less than 10,000 milligrams per liter (mg/l) within the meaning of 20.6.2.3101.A NMAC;
3. Discharge from the former Site operations is not subject to any of the exemptions of 20.6.2.3105 NMAC;
4. HMC is required to abate ground water contamination pursuant to 20.6.2.3107.A.(11) NMAC and 20.6.2.3109.E.(1) NMAC except as provided in 20.6.2.4105 NMAC because the discharges of effluent or leachate from the former Site operations have contaminated ground water of the State of New Mexico, which has an existing concentration of 10,000 mg/l or less of TDS, and



**2013 ANNUAL MONITORING REPORT / PERFORMANCE REVIEW  
FOR  
HOMESTAKE'S GRANTS PROJECT  
PURSUANT TO  
NRC LICENSE SUA-1471 AND DISCHARGE PLAN DP-200**

**FOR:**

**U.S. NUCLEAR REGULATORY COMMISSION NEW MEXICO  
ENVIRONMENT DEPARTMENT  
AND**

**BY:**

**HOMESTAKE MINING COMPANY OF CALIFORNIA  
GRANTS, NEW MEXICO**

**AND**

**HYDRO-ENGINEERING, LLC  
CASPER, WYOMING**

**MARCH, 2014**

BRANDON WEAVER      ADAM ARGUELLO      GEORGE L. HOFFMAN, P.E.

**GROUND WATER MONITORING  
FOR HOMESTAKE'S GRANTS PROJECT**

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PONDS APPENDIX E: LAND USE REVIEW / SURVEY APPENDIX F: TAILINGS  
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### **3.0 SITE STANDARDS AND BACKGROUND CONDITIONS 3.1 SITE STANDARDS**

#### **ALLUVIAL**

Ten water-quality site standards (U, Se, Mo, SO<sub>4</sub>, Cl, TDS, NO<sub>3</sub>, Ra226 + Ra228, Th230 and V) have been set for the alluvial aquifer at the Homestake site by the United States Nuclear Regulatory Commission (NRC) and the site Radioactive Materials License was amended accordingly. These site standards were established on the basis of defining the full range in alluvial aquifer background concentration values for these constituents. The procedures used to establish background concentrations and subsequent setting of appropriate site standards were reviewed and approved by the NRC, the EPA, and the New Mexico Environmental Department (NMED). Adjustment of the site standards to account for the full range in natural background concentrations was important in assuring that appropriate site standards are set in relation to background concentrations.

The NRC alluvial aquifer site standards are shown in Table 3.1-1 and will be incorporated in the New Mexico Environment Department (NMED) DP-200 Discharge Plan when the permit is renewed. Alluvial site standards for the Grants Project are applicable at three points of compliance; these Point of Compliance (POC) wells are S4, D1, and X (see Figure 3.2-1 for locations); these wells are situated west and south of the tailings site locations.



**TABLE 3.1-1. GRANTS PROJECT ALLUVIAL SITE  
STANDARDS.**

<b>Constituents</b>	<b>NRC License Site Standards</b>	<b>New Mexico Site Standards*</b>
Uranium	0.16	0.16
Selenium	0.32	0.32
Molybdenum	0.10	1.0**
Vanadium	0.02	-----
RA-226 + Ra-228	5	30
Thorium-230	0.3	-----
Sulfate	1500	1500
Chloride	250	250
TDS	2734	2734
Nitrate	12	12

NOTE. All concentrations are in mg/l except: Ra-226 + Ra-228 and Th-230, which are in pCi/l.

\* = Pending NMED renewal of DP-200 Discharge Plan

\*\* = New Mexico Irrigation Standard

### 3.3 CHINLE SITE STANDARDS

Eight water quality site standards (U, Se, Mo, SO<sub>4</sub>, Cl, TDS, NO<sub>3</sub>, and V) have been set for the Chinle aquifers at the Homestake site by the NRC. The site standards were also established based on the full range of background concentration in the Chinle aquifers for these constituents. The procedures accepted and used to establish these site standards can result in a minor amount of observed natural concentrations exceeding the site standards.

Site standards have been established for the Chinle mixing zone, Upper Chinle non-mixing zone, Middle Chinle non-mixing zone and Lower Chinle non-mixing zone. Separate site standards exist for each of these four Chinle aquifer zones. Figures 3.3-1 through 3.3-3 show the Upper Chinle, Middle Chinle and Lower Chinle aquifers with the portion of the aquifer in the mixing zone and the remainder that is in the non-mixing zone. Figure 3.3-1 presents the location of the Upper Chinle mixing-zone (yellow pattern) and the wells used in the analysis of background values. Wells within the mixing zone that were used in the mixing-zone background calculations have a red box around the well name. Wells used to define the Upper Chinle non-mixing zone are indicated by a light blue rectangular box around their name.

The mixing zone is the area in and near the subcrop area where alluvial water has entered the Chinle aquifer and changed the type of water in the mixing zone. The mixing zone has a higher calcium concentration and is similar to the alluvial aquifer calcium concentration. The Chinle formation still has the ability to change the water type as the alluvial water moves farther down gradient into the non-mixing zone.

Table 3.3-1 below presents the Chinle site standards for the four Chinle aquifer zones.

**TABLE 3.3-1. GRANTS PROJECT - CHINLE SITE STANDARDS**

Aquifer Zone	CONSTITUENT, concentrations in mg/l except Thorium-230 and Ra226+Ra228 in pCi/l									
	Selenium	Uranium	Molybdenum	TDS	Sulfate	Chloride	Nitrate	Vanadium	Thorium-230	Ra-226 +Ra-228
Chinle Mixing	0.14	0.18	0.10	3140	1750	250	15	0.01	*	*
Upper Chinle Non-Mixing	0.06	0.09	0.10	2010	914	412	*	0.01	*	*
Middle Chinle Non-Mixing	0.07	0.07	0.10	1560	857	250	*	*	*	*
Lower Chinle Non-Mixing	0.32	0.03	0.10	4140	2000	634	*	*	*	*

\* Background water quality analyses for constituent determined that site standard is not necessary





**Human Health Risk Assessment**  
**Homestake Mining Co. Superfund Site**  
**Cibola County, New Mexico**

**December 2014**

**Prepared By**

**Dr. Ghassan A. Khoury**

**Risk and Site Assessment Section (6SF-TR)**

**United States Environmental Protection Agency**

**Region 6**

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**Table 5-3. Estimated excess lifetime cancer risk from radionuclides exposure by an RME individual living at the Five Subdivisions residential community located offsite and downgradient from HMC Superfund site assuming a current/future residential scenario.**

Medium	Exposure Pathway	Radionuclides Of Primary Concern	Cancer Risk- Five Subdivisions	Cancer Risk- Background	Site Related Excess Lifetime Cancer Risk
<u>Soil</u>	Ingestion, external, inhalation and produce consumption	Ra-226+D (external exposure)	$2.4 \times 10^{-4}$	$1.8 \times 10^{-4}$	<u><math>6.0 \times 10^{-5}</math></u>
<u>Air</u>	Inhalation of Ambient Air	Rn-222 +D (inhalation)	$1.8 \times 10^{-3}$	$1.3 \times 10^{-3}$	<u><math>5.0 \times 10^{-4}</math></u>
Total			$2.0 \times 10^{-3}$	$1.5 \times 10^{-3}$	$5.6 \times 10^{-4}$
Well Water  Added Risk <sup>1</sup>	Ingestion and inhalation	Rn-222+D &  Ra-226 +D (inhalation)  Ra-228+D (ingestion)	$2.2 \times 10^{-3}$	See <sup>2</sup>	See <sup>2</sup>

<sup>1</sup> This is the added cancer risk from exposure to radionuclides in well water in the event that a well is dug and used for domestic purposes sometime in the future. Currently all residents except for one Valle Verde resident are on Milan municipal water system. The risk include background ground water risk.

<sup>2</sup> A true background was not determined for the site.

#### **5.1.4.2 Residential Scenario- Chemicals of Potential Concern**

The estimated excess lifetime cancer risk from exposure to chemicals of potential concern in soil at the Five Subdivisions is  $1.2 \times 10^{-5}$  in a residential setting. The residential scenario assumes exposure to soil through the incidental soil ingestion route, inhalation of COPC in airborne particulates, and dermal contact with soil. The risk is primarily due to arsenic through the incidental ingestion of soil which posed a potential risk of  $1.1 \times 10^{-5}$  (see table 5-4). The estimated excess lifetime cancer risk from exposure to chemicals of potential concern in soil at the background area is  $1.3 \times 10^{-5}$ . The risk is primarily due to arsenic through the incidental ingestion of soil. Therefore cancer risk from COPC at the site is similar to background cancer risk.



